



THE NATIONAL ENCYCLOPEDIA

EDITOR IN CHIEF

HENRY SUZZALLO, Ph.D., Sc.D., LL.D.

Professor of the Philosophy of Education in Columbia University (1909-1915)

President of the University of Washington (1915-1926)

Director of the National Advisory Committee on Education (1929-1931)

*President of the Carnegie Foundation for the
Advancement of Teaching*

EDITORIAL DIRECTOR

W. W. BEARDSLEY



VOLUME THREE

NEW YORK

P. F. COLLIER & SON COMPANY

COPYRIGHT 1932

P. F. COLLIER & SON COMPANY

COPYRIGHT 1933

P. F. COLLIER & SON COMPANY

ALL RIGHTS RESERVED

MANUFACTURED IN THE UNITED STATES OF AMERICA

The National Encyclopedia

CONTRIBUTORS · VOLUME THREE

- A.A.K.** ANSEL A KNOWLTON, A.B., A.M., Ph.D.
Professor of Physics, Reed College, Author of *Physics for College Students* and *A Laboratory Manual for Physics*
- A.B.** AARON BAKST, B.S., A.M.
Assistant in Mathematics, Teachers College, Columbia University, Inventor of the Bakst Solid Geometry Models
- A.B.A.** ARTHUR BARTO ADAMS, A.B., M.A., Ph.D.
Dean of College of Business Administration and Professor of Economics, University of Oklahoma.
- A.B.J.** ABIGAIL BROWN JOHNSON, A.B.
Author of articles on American birds, food fishes and forest trees
- A.B.L.** ARNO BENEDICT LUCKHARDT, Ph.D., M.D.
Professor of Physiology, University of Chicago, Discoverer of Lihylene Anesthesia, Fellow of the American Medical Association, Member, Chicago Institute of Medicine
- A.B.S.** ARLOW BURDETTE STOUT, Ph.D.
Director of Laboratories, New York Botanical Garden.
- A.B.W.** ALBERT BENEDICT WOITTE, A.B., A.M., Ph.D.
Professor of Economics and Chairman of the Department of Economics, Ohio State University
- A.C.F.** ARNO CARL FIELDNER, B.Sc. in CHIM. E. CHEM. ENGR.
Chief Engineer, Experiment Stations Division, United States Bureau of Mines.
- A.E.E.** ALVIN ELLAZER EVANS, A.B., J.D., Ph.D.
Professor of Law and Dean of the College of Law, University of Kentucky
- A.E.Z.** ADOLF F. ZUCKER, A.B., A.M., Ph.D.
Professor of Comparative Literature, University of Maryland, formerly Assistant Professor of English, Peking Union Medical College
- A.F.A.** ARTHUR FRIDERICK ABT, S.B., M.D.
Instructor, Northwestern University Medical School, Division of Pediatrics, Attending Pediatrician, Michael Reese Hospital, Chicago.
- A.F.H.** ALFRED FABIAN HESS, B.A., M.D., Sc.D.
Children's Specialist, Recipient of John Scott Award, 1927, for devising a method of producing a vitamin factor in food by means of ultra violet rays, Member of the Association of American Physicians
- A.F.L.** ARTHUR FLETCHER LUCAS, M.A., Ph.D.
Associate Professor of Economics, Clark University, Instructor in Economics, Princeton University.
- A.H.H.** ALBERT HUNTINGTON HOOKER, M.S.
Technical Director, Hooker Electro-Chemical Co., Niagara Falls, N.Y.
- A.H.S.** ALFRED H SWELF, A.B., A.M., Ph.D.
Professor of European History, Washington and Jefferson College, Author of *A History of England*.
- A.I.W.** ALICE I. WRIGHT, A.B.
Research Specialist in Zoology, Technical Assistant, Beche Bermuda Expedition
- A.J.C.** ARTHUR JOSEPH CRAMP, M.D.
Director of the Bureau of Investigation, American Medical Association, Member of the Institute of Medicine, Chicago, and Royal Institute of Public Health
- A.K.C.** ANANDA K COOMARASWAMY, D.Sc.
Vice-President, India Society, London, Fellow for Research in Sudan, Persian and Mohammedan Art, Museum of Fine Arts, Boston
- A.L.L.** ANNA LANE LINGTLBACH, A.B., Ph.D.
Lecturer in History, Bryn Mawr College, Professor of History, Temple University, Member of the Philadelphia Board of Public Education.
- A.P.** ALAN PRIEST, A.B.
Curator of the Department of Far Eastern Art, Metropolitan Museum of Art
- A.Se.** ALFRED SENN, Ph.D.
Professor of Germanic and Indo-European Philology, University of Wisconsin.
- A.Sh.** ABRAHAM I. SHINEDLING, A.B., A.M.
Staff Revision and Research Editor, the *Standard Jewish Encyclopedia*, Rabbi in American Jewish communities
- A.S.H.** ALBERT SPEAR HITCHCOCK, B.S., M.Sc., D.Sc.
Principal Botanist in charge of Systematic Agrostology, United States Department of Agriculture, Bureau of Plant Industry
- A.T.B.** ALLEN TIBBOTS BURNS, A.B.
Executive Director, Association of Community Chests and Councils, President, National Conference of Social Work.
- A.T.M.** ALBERT THOMAS MITCHELSON, C.E.
Senior Irrigation Engineer, Bureau of Agricultural Engineering, United States Department of Agriculture
- A.W.T.** ARTHUR WALDORF THOMAS, M.A., Ph.D.
Professor of Chemistry, Columbia University.
- A.Z.** ANTHONY ZELLENY, Ph.D.
Professor of Physics, University of Minnesota, Author of *Elements of Electricity*
- B.C.G.** BENJAMIN CHARLES GRUENBERG, A.M., Ph.D.
Educational Editor, Author of *Elementary Biology, Biology and Human Life, The Story of Evolution and Guidance of Childhood and Youth*.
- B.F.** BERNARD FANTUS, M.S., M.D.
Professor of Therapeutics, University of Illinois, Member of the Revision Committee of the National Formulary and United States Pharmacopoeia
- B.F.K.** BENJAMIN FREYMAN KINGSBURY, Ph.D., M.D.
Professor of Histology and Embryology, Cornell University, Fellow of the American Medical Association and Association of American Anatomists
- B.H.B.** BENJAMIN HAGGOTT BECKHART, M.A., Ph.D.
Associate Professor of Banking, School of Business, Columbia University
- B.H.C.** BARRETT H CLARK.
Author and Editor, Author of *European Theories of the Drama, A Story of the Modern Drama* and *Eugene O'Neill*

- B.L.** BELA LOW, MIN E
Consulting Mining Engineer. Author of articles on metal mining and mineral deposits
- B.M.** BROADUS MITCHELL, A B, PH D
Associate Professor of Political Economy, Johns Hopkins University, Author of *The Industrial Revolution*
- B.Mi.** BLANCHIE VALENTINE MITCHELL, M A
Assistant Professor of Italian, Smith College
- C.A.G.** CHARLES ADAMS GULICK, JR., A B, A M, PH D
Associate Professor of Economics, University of California.
- C.B.D.** CHARLES BENEDICT DAVENPORT, A M, PH D
Director, Department of Genetics, Carnegie Institution of Washington.
- C.C.P.** CARL CAPPING PLEHN, A B, PH D, LL D
Professor of Finance, Department of Economics, University of California
- C.E.M.** CHARLES EARL MULLIN, M.Sc., D.Sc., F.A.I.C., F.C.S., F.T.I., F.S.C.A.S.
Consulting Chemist and Head of the Division of Textile Chemistry Rayon and Dyeing, Clemson College
- C.E.S.** CARL EMIL STASHORE, PH D, LL D, Sc D
Dean of the Graduate College and Head of the Department of Psychology, State University of Iowa
- C.E.W.** COLSTON ESTEY WARNE, A B, M A, PH D
Associate Professor of Economics, Amherst College
- C.F.B.** CHARLES FERGUS BINNS, Honorary M.S., D.Sc.
Director, New York State College of Clay Working and Ceramics
- C.F.We.** CLIFTON FAIRCHILD WEIDICH, B A, LL B
Attorney. Member of the New York and Connecticut Bar Associations
- C.H.C.** CHARLES H COLVIN, M.E.
President and General Manager, Pioneer Instrument Co., Brooklyn, NY
- C.H.P.** CHESTER H PENNING, A B, B.Sc. in CHIMIE.
Engineer. Technical Sales Department, Tennessee Eastman Corporation, Kingsport, Tenn
- C.H.Po.** CLIFFORD HILLHOUSE POPE, B A
Assistant Curator of Herpetology, American Museum of Natural History, New York City
- C.L.A.** CARL LUCAS ANDERBERG, B A, M A, M D
Director, Food Research Institute, Stanford University
- C.L.C.** CLAUDE LESTER CLARK, B.S.E., M.S.E., PH D
Research Engineer in Metallurgy, Department of Engineering Research, University of Michigan
- C.M.J.** CHARLES MORRIS JOHNSON, PH B, PH M
Chief Chemist and Consulting Metallurgist, Crucible Steel Company of America
- C.St.** CARL STEPHENSON, PH D
Professor of History, Cornell University
- C.T.** CLARK TIBBITTS, B S
Research Sociologist, President's Research Committee on Social Trends, University of Chicago.
- C.W.C.** CHARLES WOOLSEY COLE, A B, A M., PH.D.
Instructor in History, Columbia University
- C.W.P.** CHARLES W PORTER, B A, M A, PH D
Acting Assistant Professor of History, University of Virginia, 1932-33, Franco-American Exchange Fellow, University of Lyons, France, 1928-29
- C.Z.K.** CHARLES ZITLER KLAUDER, M.F.A.
Ex-president, Architectural League, New York, Corresponding Member of the Central Association of Austrian Architects, Co-author of *College Architecture in America*
- D.E.S.** DAVID EUGENE SMITH, PH B., PH M., M.Pd., PH D, LL D., D.Sc.
Professor Emeritus of Mathematics, Columbia University
- D.P.B.** DAVID PRESCOTT BARROWS, A M, PH D, LL D
Professor of Political Science, University of California, Director of Education in the Philippines, 1903-09, Director of the Food Supply of Brussels, 1916, Carnegie Visiting Professor of International Relations (Latin America), 1928
- E.A.F.** EDWARD A FHEENE, LL D
President, William Filene's Sons Co., Boston, Advisory Councillor and ex-officio member, General Committee on Trade Barriers, Industrial Chamber of Commerce
- E.A.H.** EARNEST ALBERT HOOTON, PH D., B.LITT
Professor of Anthropology and Curator of Somatology, Peabody Museum, Harvard University
- E.A.K.** EDWARD ALBERT KREGER, B.Sc.
Major General, United States Army, Retired, formerly Professor of Law, United States Military Academy, and Judge Advocate General of the United States Army
- E.C.Br.** EDGAR CLAY BRITTON, A B, PH D
Assistant Director of Organic Research, Dow Chemical Co., Midland, Mich
- E.D.B.** E. DOUGLAS BRANCH, PH D
Research Associate, State Historical Society of Iowa
- E.D.F.** EDWIN DANIELS FOWLE, B.T.F.
Associate Editor, *Textile World*
- E.E.B.** EDWARD EZRA BAUER, B.S., M.S., C.E.
Assistant Professor of Civil Engineering, University of Illinois
- E.H.V.** ERNEST HENRY VOLWILER, A B, M A, PH D
Director of Research, Abbott Laboratories, North Chicago, Ill., Chairman, Chicago Section, American Chemical Society, Editor of *Chemical Bulletin*
- E.I.** ERNEST INGERSOLL
Editor of the Department of Natural History, *The Weekly Star*, Montreal
- E.M.B.** EDWIN MYRON BAKER, B.Sc.
Associate Professor of Chemical Engineering, University of Michigan, Consulting Engineer
- E.M.D.** EDWIN MERRICK DODD, JR., A B, LL B
Professor of Law, Harvard Law School, formerly Professor of Law at the Universities of Nebraska and Chicago
- E.M.S.** EDWARD MCCIFNEY SALT, B A, M A, PH D
Professor of Political Science, Pomona College
- E.M.Sy.** ERNEST M. SYMMES, S.B.
Chemical Engineer, Hercules Powder Co
- E.P.Z.** ERWIN P. ZEISLER, A B, M D
Assistant Professor of Dermatology, Northwestern University Medical School, Attending Dermatologist, Michael Reese and Cook County Hospitals, Chicago
- E.Ro.** EDWIN ROEDDER, A B, M A., PH D
Professor of German Language and Literature, College of the City of New York
- E.W.B.** ERNEST WATSON BURGESS, A B, PH D.
Professor of Sociology, University of Chicago, Secretary of the American Sociological Society, 1921-30
- E.W.P.** ELBRIDGE W PALMER
President, Kingsport Press, Kingsport, Tenn., Member of the International Association of Electrotypers, Southern Master Printers Federation, Bookbinders Guild, New York
- F.H.C.** FRED HERBERT COLVIN
Editor, *American Machinist*, Life Member, Franklin Institute

- F.L.H.** FREDERICK LUDWIG HOFFMAN, LL.D.
Statistician, Prudential Insurance Company of America,
Chairman of the Committee on Labor Statistics, Council for
National Defense, 1917-18, President, American Statistical
Association, 1912
- F.N.S.** FRANK NEWMAN SPILLER, B.A.Sc., D.Sc.
Director of Research Department of Metallurgy, National
Tube Co., Pittsburgh, Franklin Institute Medallist.
- F.R.H.** FRIDERIC R. HARRIS, M.E., D.E.
Rear Admiral, United States Navy, Retired, Consulting
Engineer, Aldred Lecturer on Docks and Ports, Johns Hop-
kins University, Chief of Bureau of Yards and Docks, Navy
Department, and General Manager, Emergency Fleet Cor-
poration, 1915-17.
- G.A.C.** GLENN ARTHUR CUMINGS, B.S. in Agr.E.
Agricultural Engineer, Bureau of Agricultural Engineering,
United States Department of Agriculture, formerly Assis-
tant Professor in Agricultural Engineering, University of
Wisconsin
- G.A.H.** GEORGE ALBERT HOOL, S.B.
Consulting Structural Engineer, formerly Professor of Struc-
tural Engineering, University of Wisconsin
- G.A.O.** GEORGE A. ORROR, M.E.
Consulting Engineer, New York City, Member of the
American Society of Mechanical Engineers, American
Society of Civil Engineers
- G.A.P.** GEORGE A. PROCHAZKA, JR., M.E.
Chemical Economist, DuPont Ammonia Corporation
- G.A.R.** GRACE A. REEDER, A.B., A.M.
Secretary of the Child Welfare Division of the Welfare
Council of New York City
- G.C.** GROVER CLARK, A.B., A.M.
Adviser on the Far East, Social Science Research Council,
1932- , Lecturer, Columbia University
- G.C.P.** GEORGE C. PIDGEON, B.D., D.D.
First Moderator of the United Church of Canada, Moder-
ator of the General Assembly of the Presbyterian Church
in Canada, 1925-26.
- G.D.** GEORGE DRAPER, A.B., M.D.
Associate Professor of Clinical Medicine, College of Physi-
cians and Surgeons, Columbia University
- G.E.R.** GEORGE EMIL RAYNOR, B.S., M.A., Ph.D.
Assistant Professor of Mathematics, Lehigh University
- G.K.N.** G. KINGSLEY NOBLE, A.M., Ph.D.
Curator, Department of Herpetology and Experimental
Biology, American Museum of Natural History
- G.M.H.** GEORGE McLEAN HARPER, JR., M.A., Ph.D.
Assistant Professor of Latin, Yale University.
- G.R.F.** GRACE R. FOWLER, A.B.
Specialist in Cosmetics and Merchandising
- G.R.N.** GILBERT ROSCOE MERRILL, B.S. in Text. E.
Professor and Head of the Department of Cotton Yarns and
Knitting, Lowell Textile Institute, Lowell, Mass., Special
Expert for United States Tariff Commission
- G.R.N.** GEORGE RAPALL NOYLS, A.B., A.M., Ph.D.,
Litt.D.
Professor of Slavic Languages, University of California
- G.T.S.** GEORGE TILLEY SEABURY, S.B. in C.E.
Secretary, American Society of Civil Engineers, formerly
in charge of water supply construction for large munici-
palities
- G.W.M.** GEORGE WALKER MULLINS, Ph.D.
Professor of Mathematics, Barnard College, Columbia Uni-
versity
- H.A.C.** HOWARD ALEXANDER CARTER, B.S. in M.E.
Secretary, Council on Physical Therapy, American Medical
Association.
- H.A.G.** HENRY ALLAN GLEASON, Ph.D., B.S., A.M.
Curator, New York Botanical Garden.
- H.B.W.** HALL B. WHITE, M.S.
Agricultural Engineer, Division of Agricultural Engineer-
ing, University of Minnesota, Member of the American
Society of Agricultural Engineers
- H.B.Wa.** HENRY BALDWIN WARD, Ph.D., D.Sc., A.M.
Professor of Zoology and Head of Department of Zoology,
University of Illinois.
- H.C.Sm.** HOWARD CASWELL SMITH, A.B.
Partner, Hathaway & Co., Member of the Executive Com-
mittee of the Chamber of Commerce of the State of New
York, Chairman of Board, D. Appleton & Co.
- H.E.B.** HARRY ELMER BARNES, A.B., A.M., Ph.D.
Professor of History and Sociology, Smith College, Member
of the American Academy of Political and Social Science
and the Royal Economic Society.
- H.E.Ba.** HARRY EVERETT BARNARD, B.S., D.Sc., Ph.D.
Director, Corn Industries Research Foundation and of the
White House Conference on Child Health and Protection
- H.F.G.** HERBERT F. GOODRICH, A.B., LL.B., LL.D.
Professor of Law, Vice President in charge of the Law
School, University of Pennsylvania.
- H.G.P.** HENRY GEORGE PONCHIER, M.D.
Assistant Professor of Pediatrics, University of Illinois
- H.L.S.** HARRY L. SHAPIRO, A.B., A.M., Ph.D.
Associate Curator of Physical Anthropology, American Mu-
seum of Natural History
- H.M.** HERMON MORE
Curator, Whitney Museum of American Art, New York City.
- H.M.H.** HENRY MITCHELL HOBART, B.S. in E.E.
Consulting Engineer, General Electric Co., First Vice-Direc-
tor of the American Bureau of Welding
- H.N.W.** HENRY NELSON WEFMAN, A.B., Ph.D.,
D.D., Litt.D.
Professor of the Philosophy of Religion, Divinity School,
University of Chicago
- H.P.** HERMANN PRINZ, D.D.S., A.M., M.D., Sc.D.,
D.D.M.
Professor of Materia Medica and Therapeutics, Evans Dental
Institute, University of Pennsylvania 1913-
- H.P.S.** HARRIS PEARSON SMITH, B.S., M.S.
Chief of the Division of Agricultural Engineering, Texas
Agricultural Experiment Station
- H.P.W.** HENRY PARKER WILLIS, Ph.D., LL.D.
Professor of Banking, Columbia University
- H.S.G.** HARRY SEARLS GRADY, A.B., M.D.
Extra-Mural Professor of Ophthalmology, Northwestern
University, Chief of Ophthalmology, Michael Reese Hos-
pital, Associate Editor, *American Journal of Ophthalmology*.
- H.T.B.** HARRIET THOMPSON BARTO, A.B., A.M.
Assistant Professor of Dietetics, Department of Home
Economics, University of Illinois, formerly Instructor in
Nutrition, Teachers College, Columbia University
- H.W.B.** H. W. BROOKS.
Consulting Fuels and Power Engineer, Consulting Engi-
neer to the State of Ohio and numerous industrial and
utility corporations.
- I.A.** ISAAC ANDERSON, B.A.
Staff Member of the *New York Times*

- I.A.A.** ISAAC ARTHUR ART, M.D., D.Sc.
Professor of Diseases of Children, School of Medicine,
Northwestern University, Author of *A Year Book of
Pediatrics and Infants' Food*
- I.C.G.** IRVINE C. GARDNER, A.B., A.M., Ph.D.
Physicist, United States Bureau of Standards.
- I.G.** ISAAC GOLDBERG, A.B., A.M., Ph.D.
Lecturer, Hispano-American Literature, Harvard University.
- I.M.** ISAAC MENDELSSOHN, M.A.
Instructor in Semitic Languages, Columbia University
- I.P.** ISADORE PILOT, M.D., B.S.
Associate Professor of Medicine, College of Medicine, Uni-
versity of Illinois.
- J.A.** JEROME ALEXANDER, B.Sc., M.Sc.
Consulting Chemist and Chemical Engineer, Member of
The American Institute of Chemical Engineers, The American
Chemical Society, The National Research Council
- J.B.** JULES BLOCH, Docteur es Lettres
Professor at the Ecole Nationale des Langues Orientales and
the Ecole Pratique des Hautes Etudes, Paris
- J.Ba.** JACQUES BARZUN, A.B., A.M., Ph.D.
Instructor in History, Columbia University
- J.B.H.** J. BARTON HOAG, A.B., Ph.D.
Assistant Professor of Physics, University of Chicago, Presi-
dent of the Chicago Section, Institute of Radio Engineers.
- J.C.A.** JOHN CLARK ARCHER, B.A., B.D., M.A., Ph.D.
Hobbes Professor of Comparative Religion, Yale University;
active in Christian Education in India and Near East.
- J.C.C.** JOSEPH CUMMINGS CHASE
Professor and Head of the Art Department, Hunter Col-
lege, Official Portrait Painter for the United States Gov-
ernment with the American Expeditionary Forces
- J.G.** JERUTHIEL GINSBURG, M.A.
Professor of Mathematics, Yeshiva College, and Associate
in Mathematics, Teachers College, Columbia University
- J.H.** JOHN HAMILTON.
Principal Scientific Aid to the Carbohydrate Division of
the Bureau of Chemistry and Soils, United States Depart-
ment of Agriculture
- J.H.N.** JOHN H. NAIR, B.S.
Assistant Director, Research Laboratory, Borden Co
- J.H.Wu.** JOHN HENRY WUORINEN, A.B., A.M., Ph.D.
Instructor in History, Columbia University, Consulting Edi-
tor, Social Science Abstracts
- J.J.** JOSEPH JASTROW, A.B., A.M., Ph.D., LL.D.
Lecturer on Psychology, New School for Social Research,
Professor Emeritus, University of Wisconsin
- J.J.L.D.** JAN JULIUS LODIEWYK DUYVENDAK, Ph.D.
Professor of Chinese, University of Leyden, Visiting Pro-
fessor, Columbia University, formerly Chinese Secretary of
the Netherlands Legation, Peking, China
- J.L.F.** JAMES LLOYD FRI, M.B.A.
Manager of the Merchandise Managers' Division, National
Retail Dry Goods Association.
- J.M.** JAMES MOHATT, M.A., B.D., D.Litt., D.D., LL.D.
Washburn Professor of Church History, Union Theological
Seminary
- J.Ma.** JOHN MARTIN.
Dance Critic, *New York Times*, Faculty Lecturer, New
School for Social Research.
- J.P.G.** JACOB P. GREENHILL, B.S., M.D., F.A.C.S.
Associate in Obstetrics, Northwestern Medical School and
Attending Gynecologist, Cook County Hospital.
- J.R.T.** JAY R. TRAVER, B.A., M.A., Ph.D.
Instructor in Entomology, Cornell University
- J.T.B.** JOHN THOMAS BOWEN, B.S.
Senior Electrical Engineer, Bureau of Agricultural Engi-
neering, United States Department of Agriculture
- J.W.W.** JOHN WOMACK WRIGHT, LL.B.
Professor of Military Science and Tactics, University of
Missouri, Colonel, United States Army
- K.C.** KENNETH JOHN CONANT, A.B., M.Arch., Ph.D.
Associate Professor of Architecture, Harvard University
- K.D.S.** KENNETH D. SULTZER, A.B.
Instructor in English and Supervisor of Admissions, Home
Study Department, Columbia University
- K.N.L.** KARL NICKERSON LLEWELLYN, LL.B., J.D.
Betts Professor of Jurisprudence, Columbia University
- K.T.** KURT TOENSELDT, B.S., M.E.
Manager, Patent Department, International Combustion
Engineering Corporation, New York.
- L.Br.** LAWRENCE BROWN, B.S.
Writer and Translator from German and French, Staff
Member of the *New York Herald-Tribune*, 1926-28
- L.B.S.** LOUIS BEVIER SPINNEY, B.S., B.M.E.
Professor of Physics, Iowa State College
- LeR.E.B.** LEROY EDWARD BOWMAN, A.B.
Secretary of the National Community Center Association
- L.H.G.** LOUIS HERBERT GRAY, A.B., A.M., Ph.D.
Professor of Oriental Languages, Columbia University,
Member of the American Linguistic Society
- L.H.Mo.** LACEY H. MORRISON, B.S. in M.E.
Associate Editor, *Power*, Author of *Oil Engines, American
Diesel Engines, Refrigeration, Lubrication, Fuel Oil Burning*
- L.K.B.** LESTER KRUGER BORN, A.B., M.A., Ph.D.
Assistant Professor of Classics, Western Reserve University
- L.O.C.** LEE OWEN CASE, M.S., Ph.D.
Instructor in Physical Chemistry, University of Michigan
- L.R.W.** LEON RUSSELL WESTBROOK, S.B.
Assistant Director, Experimental Laboratory, Grasselli Chemi-
cal Co
- L.Wr.** LAWRENCE WRAY, B.B.A.
Associate Editor, *Electrical Merchandising*.
- L.W.T.** LLOYD WILLIAM TAYLOR, B.Sc., Ph.D.
Professor of Physics, Oberlin College.
- M.B.H.** MARY BRONSON HARTT.
Scientific Writer and Editor.
- M.C.** MARCEL COHEN, Agrégé de l'Université, Doc-
teur ès Lettres.
Professor at the Ecole Nationale des Langues Orientales and
Director of Studies at the Ecole Pratique des Hautes
Etudes, Paris.
- M.F.** MORRIS FISHBEIN, B.Sc., M.D.
Editor, *The Journal of the American Medical Association*,
Associate Clinical Professor of Medicine, University of Chi-
cago.
- M.F.B.** MARY FLORENSIA BOGUE, A.B., A.M.
Executive Director, National Federation of Day Nurseries,
former State Supervisor, Mothers' Assistance Fund of Penn-
sylvania, Chairman, Family Division of the National Con-
ference on Social Work.
- M.G.** MARGARET GADSBY, B.S.
Formerly on Staff of the *Monthly Labor Review*, United
States Bureau of Labor Statistics
- M.G.K.** MAURICE GRENVILLE KAINS, B.S.A., M.S.A.
Horticulturalist, formerly Special Crop Culturist, United
States Department of Agriculture.

- M.J.Q.** MAURICE JAMES QUINLAN, B.A., M.A.
Instructor in English, Dartmouth College, formerly Instructor in Economics, Cooper Institute of Technology
- M.N.** MARCUS NADLER, B.S., J.D.
Associate Professor of Finance, New York University, and Research Director, Institute of International Finance
- M.R.** MABEL ROLLINS, A.B., M.S.
Associate in Journalism, Columbia University, Associate Editor of *McClure's*, Editor of *House Beautiful*
- M.So.** MOTT SOUDERS, JR., Ph.D.
Consulting Engineer, Ann Arbor, Mich
- N.A.-C.** NATHAN ALTSHILLER-COURT, D.Sc.
Associate Professor of Mathematics, University of Oklahoma
- N.G.** NATHAN GREENE, A.B., LL.B., S.J.D.
Lawyer, associated with Cook, Nathan and Lehman, New York City, Legal Assistant to The American Law Institute, 1926-27, Co-author of *The Labor Injunction*
- N.M.** NORMAN MACBETH
President and Illuminating Engineer of the Macbeth Daylighting Co., New York City, inventor of special lighting equipment, Owner and Editor of *Lighting Journal*, Past President, Illuminating Engineering Society
- N.T.** NORMAN TAYLOR
Formerly Curator, Brooklyn Botanic Garden, Assistant Curator, New York Botanical Garden, Editor, *Journal of the International Garden Club*, Associate Editor, *Ecology*
- N.W.** NED WAYBURN
Directing Producer and Dance Instructor Producing Director for Klaw & Erlanger and the Ziegfeld Follies
- O.B.T.** ORWELL BRADLEY TOWN
Member of the Christian Science Committee on Publications for the State of New York
- O.deL.** OTTO DE LORENZI, M.E.
Proposition Engineer, Combustion Engineering Corporation, New York City
- O.R.** OTTO REINMUTH, B.S., M.S., Ph.D.
Associate Editor, *Journal of Chemical Education*, Johns Hopkins University
- O.T.O.** OLIVER THOMAS OSBORNE, M.A., M.D.
Emeritus Professor of Therapeutics, Department of Internal Medicine, Yale University, One of the Founders of the National Tuberculosis Association
- P.C.T.** PAUL C. TRIMBLE
Managing Director, National Association of Dyers and Cleaners
- P.E.S.** PAUL EARLS SABINE, Ph.D.
Research Physicist and Consultant, Architectural Acoustics, Riverbank Laboratories, Geneva, Ill
- P.F.B.** PAUL FREDERICK BRISSENDEN, A.B., A.M., Ph.D.
Assistant Professor of Economics, School of Business, Columbia University, formerly Special Agent, United States Commission on Industrial Relations
- P.I.W.** PETER I. WOLD, B.S., E.E., Ph.D.
Professor of Physics and Head of the Department of Physics, Union College, formerly Professor of Physics, American Indemnity College, Peiping, China
- P.K.F.** PER KLEYER FROLICH, D.Sc. in Chem.E.
Assistant Director of Research, Standard Oil Development Co., Elizabeth, N.J.
- P.L.** PHILIP LEWIN, B.Sc., M.D.
Associate Professor of Orthopedic Surgery, Northwestern University Medical School, Attending Orthopedic Surgeon, Cook County Hospital and Michael Reese Hospital, Chicago
- P.N.L.** PAUL NICHOLAS LEECH, A.B., Sc.M., Ph.D.
Director of the Chemical Laboratory, American Medical Association, Fellow of the American Medical Association
- P.V.S.** PAUL VANORDEN SHAW, B.A., M.A., Ph.D., B.Sc. ET LITT.
Instructor in Latin-American History, Columbia University, Lecturer and Writer on Latin America
- P.W.W.** PHILIP WHITWELL WILSON.
Member of Editorial Staff and American Correspondent of the *London Daily News* for 21 years, Special Correspondent, *New York Times*, Member of Parliament, 1906-10
- R.A.N.** RICHARD AGER NEWHALL, B.A., M.A., Ph.D.
Professor of European History, Williams College
- R.B.K.** ROY BERNARD KESTER, B.C.S., A.M., Ph.D.
Professor of Accounting, School of Business, Columbia University
- R.B.M.** ROBERT BURNS MACMULLIN, S.B.
Research Chemist, Matheson Alkali Works, Chairman, West New York Section of the American Chemical Society
- R.C.M.** ROSWELL CHENEY MCCREA, Ph.D., LL.D.
Hebbron Professor of Economics and Dean of the School of Business, Columbia University
- R.D.H.** ROBERT DAWSON HALL.
Engineering Editor, *Coal Age*, formerly Chief Engineer, Shawmut Mining Co.
- R.E.C.** ROBERT EDWARD COONTZ, LL.D., DR. NAV. SC.
Admiral, United States Navy, Retired, Commander-in-Chief of the United States Fleet, 1923-25, Governor of Guam, 1912-13, Commandant of Midshipmen, United States Naval Academy, 1910-11
- R.E.Ch.** ROBERT EMMETT CHADDOCK, Ph.D., LL.D.
Professor of Statistics, Social Science Division, Columbia University, American Delegate to the Assembly of the International Union for the Scientific Investigation of Population Problems, Paris, 1928, London, 1931
- R.F.B.** ROY F. BERGENGREN, A.B., LL.B.
Executive Secretary, Credit Union National Extension Bureau, Boston, Mass.
- R.Gr.** ROY RICHARD GRINKER, S.B., M.D.
Associate Professor of Neurology, University of Chicago
- R.H.** ROBERT HEGNER, B.S., M.S., Ph.D.
Professor of Protozoology, Johns Hopkins University, Visiting Professor of Parasitology, University of the Philippines
- R.L.H.** ROY LINDEN HILL, A.B., A.M.
Manager, Chemical Service Section Explosive Department, Atlas Powder Co., Wilmington, Del.
- R.Mo.** RAYMOND MOLFY, Ph.D., A.M., Ph.D.
Professor of Public Law, Columbia University
- R.M.U.** RUTH MURRAY UNDERHILL, B.A.
Assistant in Anthropology, Barnard College, Columbia University
- R.M.W.** RUSSELL MORSE WILDER, Ph.D., M.D.
Professor of Medicine, Mayo Foundation, University of Minnesota, Member of the Mayo Clinic, Rochester, Minn.
- R.S.** RICHARD SCHNEIDWIND, B.S. in Chem.E., M.S.F.
Research Engineer in Metallurgy, Department of Engineering Research, University of Michigan
- R.W.** ROBERT WITTINGTON, A.B., A.M., Ph.D.
Assistant and Associate Professor of English Language and Literature, Smith College
- S.A.P.** SIDNEY A. PORTIS, B.S., M.D.
Professor of Medicine, Loyola University Medical School, Attending Physician, Cook County Hospital
- S.C.W.** SCHUYLER C. WALLACE, A.B., A.M., Ph.D.
Assistant Professor in Public Law, Columbia University
- S.D.** STUART DAGGETT, A.B., A.M., Ph.D.
Professor of Transportation, Department of Economics, University of California

S.D.F. SIMEON D. FESS, A.B., A.M., LL.B., LL.D.

United States Senator, President, Antioch College, 1907-17;
Member of the 63rd Congress and of the 64th-67th Con-
gresses, Member of the United States Senate 1925-35

S.F.K. SHERWIN FINCH KELLY, B.Sc. in Min.E.

Geologist and Geophysicist, Partner, Low & Kelly, New York.

S.J. SANDERFORD JARMAN.

Senior Instructor, Coast Artillery Tactics, Special duty,
Headquarters United States Military Academy

S.McK. SAMUEL McKEE, JR., A.B., M.A.

Instructor in History, Columbia University

S.M.G. SIDONIE MAISNER GRUENBERG, Ph.D.

Director, Child Study Association of America, Consultant
in Parent Education, Child Development Institute, Teachers
College, Columbia University.

S.R.R. SAMUEL RICE ROBINSON

Foundry Engineer, Babcock & Wilcox Co., Barberton, O.

S.R.W. SAMUEL ROBINSON WILLIAMS, Ph.D., D.Sc.

Professor of Physics, Amherst College

S.S. SOLOMON STROUSE, A.B., M.D.

Associate Professor, Clinical Medicine, Rush Medical College,
University of Chicago.

T.C.J. THATCHER C. JONES, Ph.D., M.C.S.

Assistant Professor of Finance, Department of Banking and
Finance, New York University

T.F.H. TALBOT FAULKNER HAMLIN, B.A., B.Arch.

Practicing Architect, Lecturer on the History of Architec-
ture, School of Architecture, Columbia University

T.H.D. THOMAS H. DICKINSON, A.M., Ph.D.

Associate Professor of English, University of Wisconsin,
Literary Historian, Critic and Playwright

T.H.R. THOMAS HARRISON REED, A.B., LL.B., LL.D.

Professor of Political Science and Director of Bureau of
Government, University of Michigan

T.H.S. THOMAS HENRY SANDERS, M. of Com., Ph.D.

Professor of Accounting, Harvard Graduate School of Busi-
ness Administration

T.S. THEODORF SOLLER, B.A., M.A., Ph.D.

Instructor in Physics, Amherst College.

T.St. THEODORE STEARNS, M.Mus.

Fellow of the Guggenheim Foundation, formerly Music
Critic, *The New York Morning Telegraph*

V.M. VLADIMIR MINORSKY

Professor at the National School of Oriental Languages,
Paris, formerly Counselor of the Russian Legation, Tcheran.

V.P.B. VILRAY PAPIN BLAIR, A.B., A.M., M.D.

Professor of Clinical Surgery, Washington University,
School of Medicine, Senior Consultant, Maxillo-Facial Sur-
gery, American Expeditionary Force, 1918

W.A.S. WELLS ALVORD SHERMAN

Specialist in charge of Fruit and Vegetable Division, Bu-
reau of Agricultural Economics, United States Department
of Agriculture

W.C.L. WALTER CONSUELO LANGSHAM, A.M., Ph.D.

Instructor, Department of History, Columbia University

W.C.P. WENDALL CHRISTOPHER PHILLIPS, M.D.

Otolaryngologist, Past President of the Medical Society
of the County of New York

W.E.G. WINFRED ERNEST GARRISON, D.B., Ph.D.

Associate Professor of Church History, University of Chi-
cago, Literary Editor, *Christian Century*

W.F.H. WILLIAM FREDERICK HUMMEL, Ph.B., A.M.

Lecturer in History, University of Southern California

W.H.B. WILLIAM HASTINGS BASSETT, S.B.

Metallurgical Manager, American Brass Co., Waterbury,
Conn., President of the American Institute of Mining and
Metallurgical Engineers, 1930

W.H.T. WILLIAM H. TIMBIE, A.B.

Professor of Electrical Engineering and Industrial Practice,
Massachusetts Institute of Technology, Editor-in-Chief,
War Department Committee on Education and Special
Training

W.I.F. WILLIAM I. FISHEBIN, B.S., M.D.

Assistant Health Editor, *The Chicago Daily News*, School
Physician, The Laboratory Schools, University of Chicago.

W.J.D. WALTER JULES DOUGLAS, C.E.

Consulting Engineer, Department of Bridges, Tunnels,
Buildings and Harbors, Parsons, Klapp, Brinckerhoff &
Douglas, New York City

W.J.L. WILLEM JACOB LUYTEN, Ph.D.

Professor of Astronomy and Head of the Department, Uni-
versity of Minnesota, Author of *The Pageant of the Stars*

W.J.S. WILLIAM JAPHIA SCHLICK, B.C.E., C.E.

Drainage Engineer, Engineering Experiment Station, Iowa
State College, Member of the Society of Civil Engineers

W.J.S.K. WENDELL J. S. KREIG, B.S., M.S.

Instructor in Anatomy, New York University

W.L.DeB. WILLIAM LANT DE BAUIRE, E.E., M.E.

Technical Adviser, Research Division, International Com-
bustion Engineering Corporation, New York City

W.L.McC. WARREN LEF MCCABE, Ph.D.

Assistant Professor of Chemical Engineering, University of
Michigan, Co-author of *Elements of Chemical Engineering*

W.M.H. WILBUR MAGRUDER HURST, B.S.

Associate Agricultural Engineer, United States Bureau of
Agricultural Engineering

W.O.R. WILLIAM O. RENKIN

Chief Engineer, Division of Dry Quenching, International
Combustion Engineering Corporation, New York City.

W.W. WILBERT WARD, B.A., LL.B.

Assistant Vice-President, National City Bank of New York,
Member of the New York Bar, Chairman of the Standard
Forms Committee, American Acceptance Council.

W.W.C. WINN W. CHASE.

Assistant Editor, *The Textile World*, formerly Member of
the Chemical Warfare Service

W.W.P. WILLIAM WHATLEY PIERSON, JR., A.B.,

Ph.B., A.M., Ph.D.

Professor and Dean of the Graduate School, Department of
History and Political Science, University of North Carolina

W.W.S. WILLIAM WARREN STIFLER, A.M., Ph.D.

Professor of Physics, Amherst College, formerly Head of the
Department of Physics and Dean of the Premedical School,
Peking Union Medical College, China

Y.K. YOUNGHILL KANG, B.Sc., M.E.D.

Lecturer on Comparative Literature, Department of English,
New York University

METHOD OF CROSS REFERENCES

*Words in the articles printed in large and small capitals indicate that there
is an article on that subject elsewhere in The National Encyclopedia*

The National Encyclopedia

CHICKEN-POX

C

DYSPROSIUM

CHICKEN-POX, or **VARICELLA**, an acute contagious disease occurring usually in children only. It is almost without mortality and is seldom followed by complications. The incubation period is from ten days to three weeks. Though the cause is unknown, the disease is highly contagious.

It begins with slight fever and often headache. The following day small vesicles (blisters) containing clear fluid and surrounded by a little red area appear in variable number on the back, trunk, face and limbs. In some cases there are also sores in the mouth. By the second or third day, the fever disappears and the child feels well. The blisters become filled with a thicker fluid, break open and dry into scabs. These fall off in two weeks, leaving no scars unless scratched.

Vaccination with the fluid in the blisters has been suggested and found to decrease the incidence in those exposed to infection. The only other preventive measure is isolation of exposed children.

In the treatment, care should be taken to keep the child from scratching the pustules. A soothing lotion should be applied. Baking soda baths may help to relieve the itching. W. I. F.

CHICKEN SNAKE, called also four-lined snake, popular names for a color variety of pilot snake (*Coluber obsoletus quadrimaculatus*), a harmless serpent found in the southeastern portions of the United States. It is slender, 6 to 7 ft. long, yellow, brownish or olive in color, with two yellowish stripes on either side. The head, tail, and underparts are yellowish. This snake occasionally steals young birds from chicken houses. In the North the MILK SNAKE is sometimes known as the chicken snake.

CHICK-PEA (*Cicer arietinum*), a small bushy annual of the pea family, called also garbanzo, probably a native of Asia. Of very ancient cultivation in the Old World, it is now extensively grown in California and southward in Latin American countries. The somewhat pealike wrinkled seeds, strangely swollen on one side, serve as vegetable in soups or stews, are roasted as peanuts, and used as substitute for coffee.

CHICKWEED (*Stellaria media*), a low, much-branched annual of the pink family, known also as winter-weed, satin-flower and tongue-grass. A native of the temperate Old World, the plant by naturalization has become widespread as a weed in North America and other regions. The reclining stems bear oval leaves and small white flowers, which in mild

climates, as in California and the southern states, blossom throughout the year. In colder districts, as in New York and New England, the plant is sometimes found in bloom under light snow in midwinter. Closely allied are the marsh chickweed (*S. uliginosa*) and the mouse-ear chickweeds (*Cerastium*).

CHICLAYO, a city of Peru, situated about 300 mi. northwest of Trujillo, in the department of Lambayeque. It is near the coast, and trades in sugar, a product of the surrounding district. A United States consulate is located here. Est. pop., 1927, 50,000.

CHICLE, the elastic gum of the sapodilla or naseberry tree (*Ichias Sapota*) of Central and South America, was first imported into the United States as a substitute for India rubber and balata. Since about 1890, however, it has become the chief ingredient of chewing gum, having practically driven the older spruce and paraffin wax from the market.

The resin is secured by tapping, as with the rubber tree. Zigzag cuts, close to each other, are made at an angle around the tree, sloping down to a vessel which catches the juice as it oozes from the bark. The cuts reach as high as 30 ft. on the trees and the flow from a set lasts two hours, sometimes amounting to several quarts. The juice is gathered once a day, a single "chiclero" tending from 200 to 300 trees daily. In a season these may produce a ton of gum. The trees are rested for from four to seven years between collections. The coagulated gum is boiled down two-thirds, and the resultant mass made into a block weighing about 25 lbs.

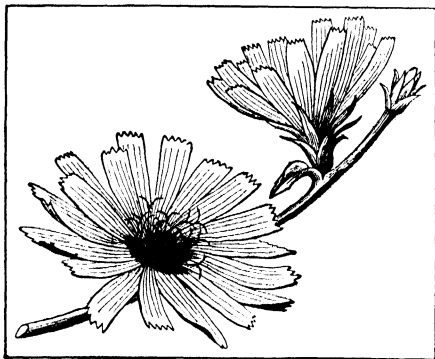
In 1928 the United States imported over 12,000,000 lbs of chicle gum from Mexico and Central America. It is estimated this made chewing gum with a value of over \$50,000,000.

CHICO, a city in Butte Co. in northern California, situated on Chico Creek, 96 mi. northwest of Sacramento, served by the Southern Pacific Railroad. The city is a manufacturing and trade center in a broad agricultural valley between the Sacramento and Feather rivers. This region produces almonds, fruit, especially prunes, alfalfa, rice and other cereals. Gold and silver are found in the county. The local industries include railroad shopwork, lumber products, matches, beet-sugar, sheet metal and broom manufacture. Chico is the seat of a United States Government plant-introduction station and a State Teachers College. Within the city limits is Bidwell Park, 2,300

acres, which contains Hooker oak with a trunk 9 ft. in diameter. The city is a gateway to LASSEN National Park, 50 mi. distant. Pop. 1920, 9,339; 1930, 7,961.

CHICOPEE, a city of Hampden Co., southwestern Massachusetts, situated 3 mi. north of Springfield, on the Connecticut River at the mouth of the Chicopee. It is served by the Boston and Maine Railroad and the Springfield Airport. The Chicopee River, falling 70 ft. in about 3 miles, furnishes power for numerous local factories. The city manufactures knit goods, cotton, machinery, textiles, drop forgings, sporting goods and automobile tires. In 1929 the factory output reached an approximate total of \$72,000,000; the retail trade amounted to \$8,237,462. Formerly some of America's finest bronze work was produced here, including the doors of the National Capitol. Chicopee, whose Indian name means cedar tree or birch-bark place, was settled by Henry Chapin in 1638; it became a town in 1848 and a city in 1890. Chicopee Falls was the birthplace of Edward Bellamy, writer and economist. Pop. 1920, 36,214; 1930, 43,930.

CHICORY (*Cichorium Intybus*), called also succory, a stiff, much branched perennial of the composite family. It is native to Europe where it has been cultivated as a food plant since Greek and Roman times. The plant, which is leafy below but bare above, grows



CHICORY

Flowering branchlet with heads of flowers viewed from above and from the side, all with strap-shaped (ligulate) corollas

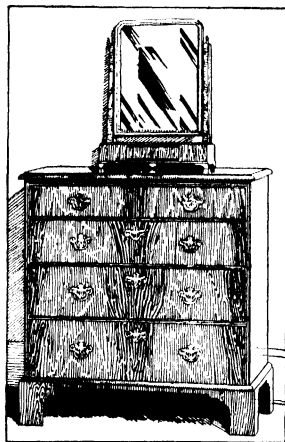
from 3 to 6 ft. high, from a fleshy taproot, and bears heads of brilliant azure blue flowers, closing about noon. The roots, when roasted and ground, were formerly much used as an adulterant of coffee, giving it increased color, bitterness and body. The roots are also used independently for making a beverage, somewhat like coffee, and when young and tender are cooked as a vegetable. The leaves are used for fodder and as a potherb, and, when blanched or in a head, as a salad. Chicory is sparingly cultivated in the United States and Canada where it has run wild extensively as a weed, sometimes becoming pernicious.

CHICOUTIMI, a town of southeastern Canada, county seat of Chicoutimi Co., Quebec, picturesquely

situated on the Saguenay and Chicoutimi rivers, 227 mi. northeast of Quebec with which city it is connected by steamboat service. Lying at the heart of a great hydroelectric power development, Chicoutimi furnishes power to the aluminum industries in the vicinity. The inhabitants are largely French-Canadians; the town contains a Roman Catholic cathedral and bishop's palace. Pop. 1921, 8,937; 1931, 11,877.

CHIEF OF STAFF, a member of the GENERAL STAFF CORPS, having the rank and title of GENERAL. He acts as the immediate advisor of the Secretary of War on all matters relating to the military establishment, and is charged with the planning, development and execution of the army program and with directing the activities of the General Staff Corps.

The title is also borne by the General Staff officer, who is the chief executive assistant of a Commander



CHIFFONIER, QUEEN ANNE PERIOD

of a Division or larger unit or of a territorial area or department and by the chief executive assistant of the commander of the corresponding fleet commands.

S. J.

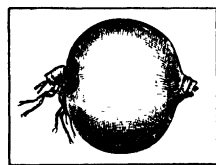
CHIEN LUNG (1711-99), the fourth emperor of the Manchu Dynasty, who ruled China from 1736 to 1796. Chien Lung, who came to the throne at the age of 25, and abdicated after reigning for a full 60 years, was one of the ablest administrators that ever has sat on any throne. He was to a high degree a soldier and a statesman as well as a scholar, a historian and a poet. In both his public and his private life he maintained notably high standards of integrity and fairness. He left the empire in better order, more prosperous and stronger than it had been for many centuries. During his reign, the contacts with Europe developed rapidly, through the visits of western traders and missionaries, and in 1795 he received Lord Macartney who headed the British mission sent out to establish better trading conditions.

CHIETI, a city of Italy, capital of the province of the same name in the Pescara valley, situated on an eminence affording a fine view. It is on the railroad between Rome and Pescara. Features of interest are an old cathedral, 1070, ruins of a Norman citadel, fine campanile, palaces and Roman remains. The chief manufactures are textiles and the trade is mostly in grain, wine and silk. The Roman Teate Marrucinorum, it fell successively into the hands of the Goths, Lombards, Franks and Normans. Pop. 1931, 33,890.

CHIFFONIER, a French term variously applied to a small cabinet enclosed by doors, a small cabinet with drawers, any ornamental cabinet, a set of open shelves for china, any ornamental piece of furniture used to contain bric-a-brac, or a high chest of drawers, with or without a mirror. The chiffonier was developed in England in the Empire style, and was made usually of dark polished wood with brass or gilded bronze trimmings.

CHIGGER, a term properly applied to a species of mites, which attach themselves to the skin of man, causing severe irritation. Often confused with the jigger or *Cimex*, a flea which also attacks man.

CHIGOE, chigger or jigger, a South American and West Indian flea (*Sarcopsylla penetrans*) of the order *Siphonaptera*. It is smaller and less powerful than the common flea but a more serious human parasite.



CHIGOE

Female distended with eggs

The impregnated females burrow beneath the skin, especially of the feet. They become distended with eggs and cause painful, even dangerous ulcers. The only remedy is to cut them out as soon as itching or tingling indicates their presence. In the southern states "chiggers" and "jiggers" are applied to harvest mites of the family *Trombididae*. The immature mites attach themselves to the skin of man and animals and become gorged with blood. They are annoying but not fatal to man though they may kill young chicks.

CHIHLI, the old name for the Chinese province in which Peiping is located. This was changed in 1928 to Hopei.

CHIHUAHUA, largest and richest state of Mexico, just south of the United States border. It has an area of 90,036 sq. mi., and a mean elevation of about 5,000 ft. above sea level. It is traversed on the west by the Sierra Madre Mountains, which slope toward the north and east to a wide level plain. The most important rivers in the state are the Rio Grande, which separates Mexico from the United States, and the Rio Conchas in the west. The climate is moderate, and the soil is sandy and alkaline, but with irrigation produces figs, peaches, apricots, grapes, melons, some grains and a high-grade honey. Chihuahua is rich in mineral wealth, and it is noted for the enormous output of gold, copper, lead and especially silver.

The most important mine is Santa Eulalia, which has been in operation since 1703. The capital of the state is Chihuahua City, and other towns are Parral, Ciudad Juarez, Jimenez, and Santa Rosalia, noted for its mineral springs. Pop. 1921, 401,622, 1930, 491,893.

CHIHUAHUA, a city of northern Mexico and the capital of the state of the same name, situated about 223 mi. southeast of El Paso, about 4,600 ft. above sea level. Rugged, barren mountains on the south, east and west surround the valley in which Chihuahua is located. Four railroads serve the city. Chihuahua is the most important city of north central Mexico, and the base of supplies for the rich mining district adjoining it. Wholesale houses do a thriving business, and there are cottonseed mills, a brewery, a soap factory, an iron foundry, a modern candy factory and, just outside the city, an immense smelter, where a colony of American employes have modern homes, a good school and other advantages. The celebrated Chihuahua el Viego or Santa Eulalia mines are nearby. Chihuahua is the educational center for a large territory. The state normal school, several private colleges and numerous public schools are located here and are all housed in good buildings. In the Plaza Hidalgo stands a monument 45 ft. high erected to the memory of Hidalgo and his adherents. The tower where he was executed in July, 1811, is now enclosed in the handsome new federal building. Tresguerras was the architect for the cathedral, a fine example of 18th century Mexican architecture. Started in 1717, its construction required 72 years.

In 1533 Spanish explorers found an old Indian town here, conquered its inhabitants, and founded a city. It was incorporated in 1823 and 41 years later it was made the temporary capital of Mexico by Pres. Benito Juarez. Revolutionary activities have often retarded its progress, but it has flourished nevertheless from its founding. Pop. 1921, 37,078, 1930, 59,607.

CHILCOTIN, a North American Indian tribe speaking a dialect of the Athapaskan linguistic stock. Their territory lay in the valley of the Chilcotin River in British Columbia. They are most closely related to the CARRIER, another Athapaskan group farther north. Now as in the past they are in contact with the BELLA COOLA and other Northwest Coast tribes. At present they live on four reservations in their original habitat. They have long abandoned their aboriginal sedentary mode of life and live much as their white neighbors, engaging in agriculture.

CHILD, FRANCIS JAMES (1825-96), American scholar, was born in Boston, Mass., Feb. 1, 1825. After graduating from Harvard he studied philology and the classics at Gottingen and Berlin, and thereafter was successively professor of rhetoric and English at Harvard. He published *English and Scottish Popular Ballads* and opened up the modern study of GEOFFREY CHAUCER by his *Observations on the Language of Chaucer*. Child died at Cambridge, Mass., Sept. 11, 1896.

CHILD AND YOUTH, GUIDANCE OF. The concept of guidance has developed in opposition to

certain features of traditional education, such as arbitrary coercion into conformity, dogmatism, and the frequently disastrous domination by those in authority. It is true that revolt against power or authority sometimes leads to other difficulties. Guidance therefore comes into contrast with the purely negative reliance upon instinct, with the idea that human happiness and adjustment can be attained by trusting to nature and doing nothing. We cannot rely upon the child's instincts and impulses to take him safely along life's journey, without direction or guidance. On the other hand, our guidance should not be too detailed, too specific, too rigid, since no two individuals ever travel the same identical road through life. The teachings of a more experienced traveler will have to do not so much with particular stretches of the regions to be traversed as with the arts of traveling comfortably and safely, of managing the affairs of the journey, of dealing with the people and the problems one is likely to encounter.

Learning Self-Direction. It has become impossible for the elders to claim that they know what is always and everywhere right and true, or that they can foretell what the future will bring. The responsibility of adults is increasingly to guide young people toward eventual self-direction. From being a hostile power that is always taking the joy out of life by prohibiting and compelling, authority must come to appear to the child as the source of help and guidance. The child should come to feel his dependence upon adults not because they are in a position to exercise power over him, but because they are able to direct him along the way he wishes to go, to assist him toward the kinds of skills and abilities he should like to have.

Among the earliest habits that the child has to acquire is a certain regularity in the everyday bodily processes, in playing and retiring, and a degree of orderliness and neatness in the management of materials and objects. Adults value these in relation to time and convenience, but to the child they have little meaning or interest. Yet it is necessary to get the child to accept such order as the normal way of life. Those who have to work with children would probably get better results, or get their results more easily, if they recognized the difference between demands that harmonize with the child's own impulses and those that do not, or that may even come into conflict with them. For through such recognition we can temper the pressure, and we can seek motivation in terms that do have meaning for the child.

Our very earnestness sometimes keeps us from getting the child's point of view, or from seeing the relative importance of the various habits we wish the child to acquire. A toddler may be permitted indefinitely to pull and handle whatever comes within his reach; but one day he may pull at the table cover, as so many times before, with the surprising result that he brings down something of value and destroys it, or something heavy and injures himself. Then the emotions aroused by the serious consequences are

transferred by the mother to the triviality that caused them. Yet it is possible for the child to learn what passes for standard practice in a thousand situations without any of those excitements that tend to distort values.

In an earlier stage of our national development nearly every boy and girl had the opportunity to discover rather early in life that minor acts or omissions, such as walking through a planted field, or leaving a gate open, might have far-reaching results. The principle is as valid to-day, but standard practices have naturally changed with the conditions of living. The boy who missed the chance of admission to the college of his choice by the comparatively slight error of assuming that a certain examination came on Wednesday, instead of Monday, missed also some valuable guidance in his earlier years. It is necessary to learn hundreds of established practices, but it is necessary also, for adults as well as for children, to understand that these rules and regulations are merely matters of convenience, in large part arbitrary, and without moral quality. We have to observe the rules of the road, the hours of coming and going, the meeting of engagements, because we thus reduce friction, make easier and pleasanter our dealings with one another, and avoid inconveniences. But there is no inherent virtue in turning to the right rather than to the left, in setting the clock by the sun rather than by an arbitrary standard, in eating dinner at noon rather than in the evening.

Difficulties Increase With Years. Those who have to carry the responsibility for adjusting the child to an acceptable and useful pattern of conduct, for insuring his safety and for guarding his health, usually find the difficulties increasing with the years. When the child's muscular development reaches a certain stage his free activities are potentially more destructive. When he learns to walk he becomes more elusive, and the range of his exploits expands. The parent is therefore tempted to extend his control beyond the reach of his hand, and seeks to build up a discipline of the word. The spoken word can be made to take the place of the hand in compelling or restraining the child's actions at a distance. This is what makes obedience appear of such great importance. According to our idea of guidance, obedience is not a basic virtue. Its cultivation may indeed carry certain dangers, such as that of extreme submissiveness, or the weakening of responsibility and discretion, or the setting up of internal conflicts between desire and purpose on the one hand and the outward conduct on the other. Obedience is a very useful instrument in the guidance of the child during a longer or shorter period, but it should never be cultivated as an end in itself. It is practicable to obtain the child's cooperation through obtaining his confidence, through developing mutual understanding and unity of aims, through the exercise of due regard for the child's own plans and purposes, and through the complete avoidance of unnecessary, arbitrary and inconsiderate commands and requests.

It is of course important for the parent to be able to control the child beyond the reach of the hand, but it is also important to anticipate the time when influence may have to be exercised beyond the reach of the spoken or written word. Discipline must therefore develop the ability for self-direction and the responsible exercise of freedom, and not be content with the establishment of acceptable practices in necessarily restricted fields of conduct and under the perpetual duress of a superior external force.

It is in the management of the child's emotional development that guidance comes into most marked contrast to the harsher forms of discipline. The fear of fire, for example, is actually cultivated by many parents as a means of keeping children away from the acknowledged dangers always present in fire. Yet fear of fire is not in itself desirable. A modern approach would undertake to teach the child in due course how to manage fires with confidence, but without ignorance of the dangers. The same principle should apply to likes and dislikes, to rivalries and envious, to group prides and prejudices.

Rewards and Punishments. Just as we cannot compel love, we cannot insure wholesome and desirable emotional attachments through any system of rewards and punishments. The natural punishments that come from the material environment in the form of bruises and scratches adequately teach most children how to guard against the dangers in handling things and forces. The application of punishment on the social level raises different problems. Unless the child somehow learns the losses and disadvantages that may come from a violation of the equities and amenities of his social relations, it is doubtful whether the rather arbitrary penalties commonly administered will teach him more than resentment against authorities, or cunning in avoiding detection, or skill in seeming what he is not. The same is true with the introduction of irrelevant rewards, where the satisfactions should come out of the actions or avoidances themselves. The purpose of guidance is to help the child discover the potential values to him in his activities and relationships.

The child of to-day will have to live with a multitude of difficulties as well as with a multitude of dangerous contrivances and forces, with people having different religious and political ideas, with utter strangers. These hazards and risks cannot be avoided; to fear them will mean to run away from them and from life. The need is to help children acquire mastery over the various sharp tools, the powerful engines, the dangerous devices, the alarming ideas, the strange peoples. Learning and mastering come, however, not from what one is prevented from doing, but from what he does.

Guidance from Educational Viewpoint. Guidance as an educational point of view came into the schools largely through the vocational guidance movement since about 1912, when the late Pres. Charles Eliot stressed the life career motive as an important factor in uniting and concentrating the efforts of

young people in school and college. Beginning with attempts to help boys and girls get their bearings with regard to future occupation, counsellors gradually extended their advice to include the selection of studies, or of colleges for further education. With the development of the mental hygiene movement guidance comes to include every phase of adjustment in which the individual can be helped by suitable counsel. The attitude of guidance is that of placing the advantages of maturity and study at the disposal of the child, without seeking to impose unnecessary restraints, private convictions or dogmas, or arbitrary patterns or codes of conduct. Moreover, the guide should not attempt to get his satisfactions at the expense of the child, by transforming him into a convert or disciple; the primary concern should be the benefit of the person guided.

The indirect methods to which educators are looking more and more for certain results are largely in the nature of guidance. We see this in the distinction which is sometimes made between ethical instruction and character training, or between sex instruction and sex education. It is possible to pass on to boys and girls a body of knowledge that remains more or less unrelated to life, whereas other influences modify the scheme of life without necessarily being taught as so many lessons. Guidance is thus often quite casual and incidental, making use of occasion and mood. For the individual affected it is a significant by-product of living with wiser or more adjusted human beings.

From the side of the parent or teacher it is important to see clearly the needs of the child as a developing human being, and as a unique individual who has his own interests and his own life to live. The child must be helped with opportunities to find himself, his resources, his limitations, his enduring purposes. He must be helped to discover many different kinds of people, to live with them harmoniously, and in many different kinds of relationship. There is something of the follower as well as of the leader in each of us, there is the possibility of becoming expert and speaking with authority, but each remains nevertheless a layman who must be ready to listen respectfully to others. The individual has to be directed toward freedom from the domination by others, but also to freedom from the need to dominate others. Guidance is needed in the management of material affairs, including the management of money. The guidance is effective and worthy in so far as it culminates in the youth's ability to go forward alone and responsibly into the world of adult realities. See *CHILD PSYCHOLOGY*.

S. M. G., B. C. G.

BIBLIOGRAPHY—W. F. Blatz, and H. Rott, *The Management of Young Children*, M. L. Fagot and J. E. Anderson, *Child Care and Training*, E. R. Groves and P. Blanchard, *Introduction to Mental Hygiene, Guidance of Childhood and Youth*, B. C. Gruenberg, editor; S. M. Gruenberg, *Your Child To-day and To-morrow*.

CHILDE HAROLD'S PILGRIMAGE, a thinly disguised autobiography in the form of a narrative poem by LORD BYRON; published between 1812-18.

Childe, an old term of honor, undoubtedly signifies the poet himself, whose wanderings over Europe are narrated with many picturesque touches, great bursts of eloquence, with many strains of melancholy and a certain amount, no doubt, of posing. Perhaps the finest sections of the four cantos which comprise this famous poem, are those that describe Venice and the Roman ruins.

CHILD GUIDANCE CLINICS, organizations for the study of various aspects of child development and for advising on or giving necessary treatment. The development of child clinics is an outcome of the child study movement and the recognition of the importance for later growth of a sound foundation. The first clinics, which were established about 1910, were directed chiefly to problems of delinquent children. Since then a variety of types of clinics have been established, some devoted to health, some to educational problems. The modern clinic recognizes that successful work involves consideration of the whole child in his physical, intellectual and emotional life, and that accurate diagnosis involves the cooperation of physicians, psychologists, psychiatrists and social workers. The function of the clinics is to guard by early diagnosis and treatment against mental disorders, delinquency, and maladjustment in school, home, or personal relations. Through the COMMONWEALTH FUND a number of community clinics have been organized, as in Cleveland, Philadelphia, St. Louis, St. Paul, Minneapolis, Dallas, Baltimore, Richmond, Milwaukee, Los Angeles and Pasadena. A number of centers have been established for research as Yale Psych-Clinic, Institute for Child Guidance in New York, Institute for Juvenile Research in Chicago, the Judge Baker Foundation in Boston, and the Institute for Child Welfare of Teachers College, Columbia University. These clinics play an important part in PARENTAL EDUCATION.

BIBLIOGRAPHY—R. P. Truitt and others, *The Child Guidance Clinics and the Community*, 1928. M. B. Sayles, *The Problem Child*, 1928. National Society for the Study of Education, *Twenty-Eighth Yearbook*, 1929.

CHILD HEALTH, a problem having as its aim the development of community plans for prenatal and postnatal clinics to safeguard the mother's health before the child's birth and to keep them both well afterwards. It also includes immunization against diseases such as diphtheria; well-child clinics where babies and pre-school children are examined for the detection of physical defects, clinics where remediable defects may be corrected; dental clinics where children are taught mouth hygiene; nutritional instruction for mothers; health education for children as a part of the school program; and habit clinics where problem children may be examined, the reason for their misbehavior discovered and the treatment outlined that will make them normal and happy. See also CHILDREN, DISEASES OF; MATERNAL AND INFANT WELFARE.

CHILD LABOR. From earliest times children have been employed in agriculture, domestic pursuits,

trades and handicrafts. Under the apprenticeship system of the 13th century and the medieval guilds, their employment was regulated to insure good working conditions, sound technical training and protection against exploitation as cheap labor. With the decline of the apprenticeship system and the development of the factory, protective regulations were removed and the increased employment of children gave rise to serious economic and social problems.

Chief Contributing Causes. With the development of the machine, the supply of adult labor was often inadequate; child labor was cheap labor; children showed a greater dexterity on simple operations; the early notion that children would find in industry protection from the vice and immorality of idleness, the provision of the poor laws which sought to prevent children from becoming public charges, family necessity, desire on the part of the children for economic independence; failure of the schools to provide proper training and to interest the child; and ignorance and avarice on the part of parents, employers and the public.

Numbers and Distribution. In 1920, the United States Census Bureau reported approximately 1,061,000 children between the ages of 10 and 15 engaged in some gainful occupation. Sixty-one percent of these were in agricultural pursuits, chiefly as farm laborers; 5.1% in domestic and personal service, 17.5% in manufacturing and mechanical industries, 7.6% in clerical occupations, 6% in trade; 1.8% in transportation and the rest in mining, professional and public service. No information is available as to the number of employed children under 10 years of age, although many thousands are at work in beet fields, cranberry bogs, cotton plantations and other agricultural pursuits as well as in street trades, tenement home work, domestic service and canneries.

Effects. Employment during the early years retards normal physical development through overstrain, insufficient rest and recreation, increased liability to accident and disease. It forces illiteracy upon the child and a lack of proper technical training, which together with the deleterious influences of work places are prolific causes of poverty, vice and crime in adult years. Employment of children lowers the adult wage, displaces adult workers and results in low earning power and premature old age, dependency, delinquency, industrial waste and a physically subnormal race of adult workers, as well as a loss of potential industrial ability.

Regulation. During the first half of the 19th century, after years of LAISSEZ-FAIRE, public conscience was aroused to the social and moral consequences of unrestricted employment of children. National and state organizations were created to arouse public opinion, and today there is a general acceptance of the doctrine that the state has both a right and a duty to protect the physical and moral well-being of children. Two Federal laws regulating the employment of children have been declared unconstitutional by the United States Supreme Court. A bill to amend

the constitution, empowering Congress to enact such legislation, passed by the Federal Congress in 1924, has to 1930, been ratified by only five states. Each state therefore regulates in its own fashion, if at all, the minimum wages for entering employment, length of working day, physical and educational qualifications for gainful employment, employment in dangerous trades and work permits. State laws vary from North Carolina, where children of 14 and 15 who have completed the 4th grade may work 11 hours a day and 60 hours a week, to Ohio, where children may not work full time during the school year unless they have passed their 16th birthday, and completed the 7th grade, with an 8 hour day for boys under 16 and girls under 18. Enforcement of such laws is difficult, however, especially in agriculture where the largest numbers are employed. The opposition of organized business interests has also resulted in serious attacks on existing laws, thus lowering standards and relaxing enforcement. There are still occupational groups to which little protection is given. There are few restrictions in agriculture and the increase in truck farming has resulted in migration of child laborers who go from state to state to work. Street trades are for the most part unprotected, although there is regulation in some communities.

Child labor is prevalent in certain foreign countries, and legislation differs greatly between countries as regards industries covered, age limit and nature of the regulations. The International Labor Office established under the peace treaty of 1919 has encouraged the establishment of minimum standards for the protection of the child worker. Through international conferences important international agreements have been reached and considerable progress has been made under their ratification. M. G.

BIBLIOGRAPHY—Publications of U. S. Children's Bureau, as *Child Labor, Fact and Figures*, also publications of National Child Labor Committee

CHILD PSYCHOLOGY forms the core of the larger interest commonly called child study. The range of data, conclusions and applications arising from the study of childhood stages of human development is so extensive that this survey must be confined to a selection of the central principles and problems.

Historical. The antecedents of child psychology may be briefly noted. J. J. Rousseau, though not the first philosopher to recognize the significance of childhood, gave expression to the fertile idea that in the human being as created by nature lay the clue to understanding of all behavior. However false his notion of a child of nature, as embodied in the untutored savage, his views influenced Froebel and Pestalozzi alike in their foundations of the kindergarten and in their theories of child development. The advent of evolution focused attention upon the genetic view and the significance of infant responses. Darwin himself contributed a study *The Biography of an Infant*. John Fiske in 1874 drew attention to the educational significance of the prolongation of infancy in the human species. W. Preyer in Germany

gathered the data for the *Mind of the Child* (Eng. trans. 1889 and 1893) and Perez did the same for French readers. G. Stanley Hall, often called the father of the Child Study Movement, made an encyclopedic survey of childhood and adolescent phases of genetic psychology, much of which appears in his *Adolescence*, 1904, and *Aspects of Child Life and Education*, 1907. Associated with the child study movement have been organizations for child welfare. Educational procedure has been guided by principles emerging from child psychology.

Heredity. The play of heredity in the individual child is so important that views of child psychology and training depend upon it. The resemblance of mental traits in siblings, brothers and (or) sisters, is marked in general and in detail. The degree of resemblance is expressed by a correlation, which would be 100 if all brothers and sisters were completely alike and would be so if they had no resemblance whatever. The actual resemblance of brothers and sisters, called Siblings to include both sexes, in a variety of typical traits, is about 50, which is high enough to be significant. Twins are much more alike. Their correlation is 80. This is decisive. The data are assembled and interpreted in Poppe's *The Child's Heredity*, 1929.

The extreme behaviorist view is taken by Watson, *Psychological Care of Infant and Child*, 1928, who minimizes the hereditary factor so decidedly as to deny it, claiming that training is capable of producing almost any result on any, not defective, basis. This position ignores so much evidence to the contrary that it is untenable; the clearly hereditary nature of special abilities makes it more so.

Developmental Stages. While development is continuous, it is both convenient and legitimate to distinguish stages that are distinctive. Such terms as infancy, early and late childhood, adolescence, may be supplemented by the educational division of the pre-school child, which includes or overlaps the nursery school and kindergarten age, leading to the early and late scholastic periods.

The search for definite indices of the stages of maturing has led to the distinction of the calendar or chronological age in years and months; the anatomical age, using such signs as the x-ray pictures of the wrist-bones; the physiological age in growth, maturing rate, and later the definite sign of puberty; the mental age, which has led to the varieties of intelligence tests; the emotional age and the social age, which must be inferred from general behavior attitudes and control. The rate of growth in children and their development at set ages vary so considerably that chronological age is an uncertain index of development; children are retarded or advanced, as well as inferior and superior in capacity. Even the correlation of mental age with physical growth is low, usually under 40, though inevitably positive, since in the great average the older are taller, heavier, maturer, farther along in intellectual development.

The variability appears best in the comprehensive

data of mental age, usually expressed as the intelligence quotient, I.Q., from which we may deduce that the capacity to grow intellectually is a fundamental determinant. The abler, brighter child is precocious; he gets an earlier start on the ladder of intelligence; he learns more rapidly, thus increasing his lead; and he continues to develop for a longer period. Hence a very low I.Q. indicates a limit of possible development. The moron is arrested at the developmental age of 10 to 12 years, the feeble-minded at a still lower age. This general relation of the growth process to total possibilities of mature development is important.

Child psychology builds upon an understanding of the growth process. Growth implies far more than increase in dimensions; it proceeds by developmental stages, and is expressed in distinctive changes in behavior. The cycles of bodily and mental growth pro-

be classified as (a) motor development; (b) language; (c) adaptive behavior; (d) personal social behavior.

The outline below selects a single instance of each type at the 3, 6, 9 and 12 month levels.

For any of these indications other equally decisive ones could be substituted. Read horizontally, from left to right, this outline indicates stages of progress in one aspect; read vertically it affords a composite sketch of capacity at the stated age. Such norms indicate the average growth process and how generally similar are infants in their maturation; differences in development rate, precocity or retardation, express the variability of children. Such a selection would be far richer and more complex for the second year; year by year it would increase cumulatively rapidly in complexity, making selection of what is typical somewhat arbitrary. The graded intelligence tests, as arranged in years, represent such a selection within a limited

field. To summarize the total development, let us say, of a child at six years in contrast to one at nine would entail a description composed into a picture.

Behavior Patterns. The picture of infancy becomes realistic in the integration of these stages of increased expression and control. How far patterns of response are inborn and how far modified by early experience was studied by Watson, who observed infants in their first contacts with mice, rabbits, dogs and fire. The so-called fear reaction was not present, though readily induced. He found but two built-in, ready to operate responses that induced some of the characteristic responses later associated with fear; the shrinking at a sudden loud noise, such as the sound of a gong, and the uneasiness when support was withdrawn. The first is a "startle" which we never lose, and the second is a sense of security associated later with the fear of falling on narrow, high, slippery places. The so-called conditioned fears (*see REFLEX*), when the child shrinks from the rabbit if the gong is sounded, is an interesting relation, but limited in its application. The emphasis upon the direction of early emotional responses is valid; but the dominant concept of maturation, though more closely applicable to the simpler infant stages, continues to apply. Gesell found that of twins showing closely parallel development, the one who was trained in walking on a ladder for a long period, while the other went without practice, neither had any advantage. The nervous system of the one had matured sufficiently during the weeks of practice for the other, so that he caught up with slight practice. The suggestion that there is a favorable period for learning for tasks of definite order and complexity, and that it is better to await that degree of maturation, is thus reinforced. The Freudian view that assigns decisive value for later development to infant experiences on the subconscious

AN OUTLINE OF PROGRESS IN INFANCY

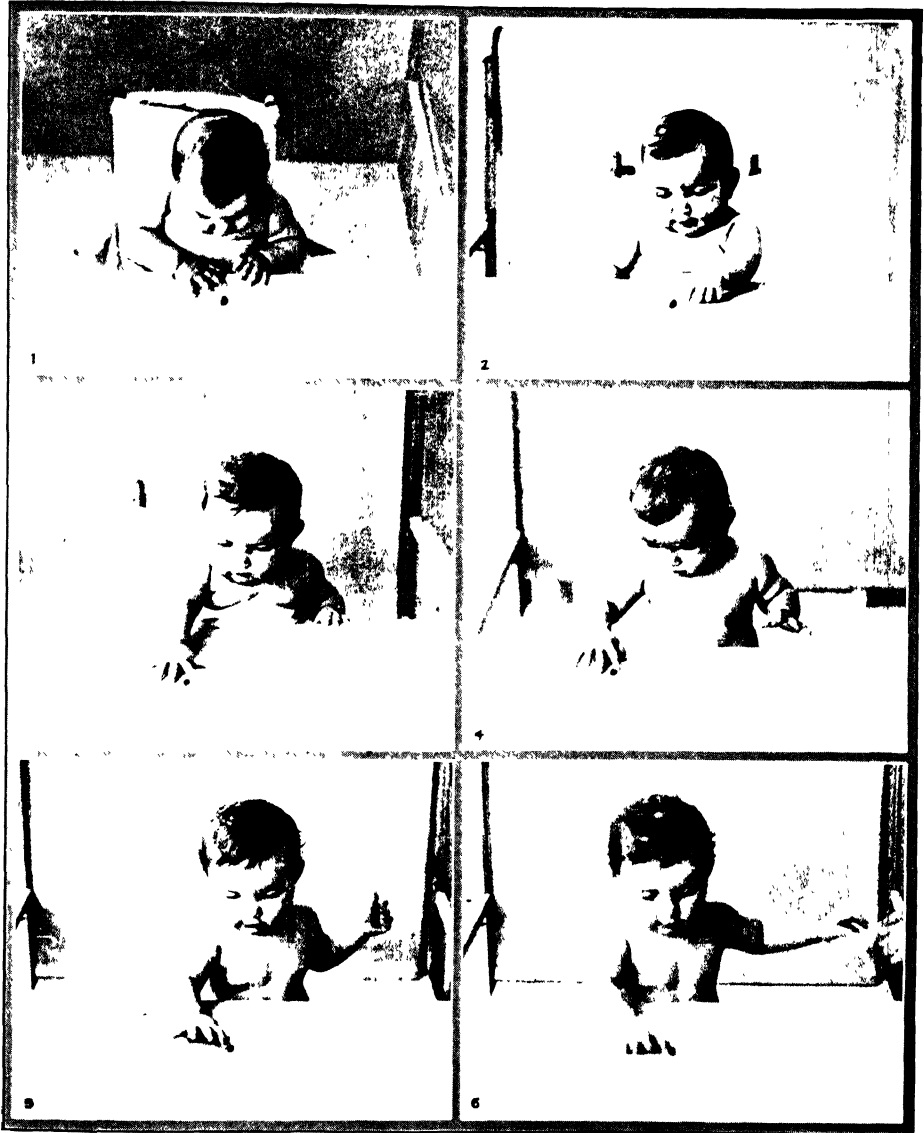
	3 Months	6 Months	9 Months	12 Months
Motor later skill	(a) holds head erect and steady when held to shoulder	sits momentarily without support	sits alone	stands and walks alone
Expression later speech	(b) smiles and chuckles	vocalizes displeasure	says Da-da, or equivalent	says four words
Adaptation later intelligence	(c) eyes follow moving pencil	reaches for and picks up objects on sight	brings block and opening into relation on form board	builds tower of two blocks
Personal Social in increasing complexity	(d) opens mouth expectantly in feeding	discriminates between strangers and family	waves bye-bye	cooperates in dressing

ceed typically in parallel relation, though in detail each follows its own developmental route, subject to specific modifications within the organism. The ages of man are related to the life cycle in its entirety. The organically conditioned ripening of early life is called maturation. The rate of growth change is most rapid in the earliest stages, indeed in the first year of life it must be measured in months. In the second month, according to Gesell, the infant doubles his developmental age, a gain of 100 per cent; 50 per cent for the third month; $33\frac{1}{4}$ per cent for the fourth, and declining to about 9 per cent for the 12th month. The rapid decline of growth rate appears in the statement that a two year old is 100 per cent in advance of a one year old, but a three year old only 50 per cent in advance of a two year old. Constantly decreasing developmental rate falls to about 9 per cent increase in the 12th year.

Orders of Development. Such statements summarize in a smooth generalization the trend and rate of growth changes. They are based upon standard selections of behavior by which such progress may be measured or estimated. Such orders of behavior may

be classified as (a) motor development; (b) language; (c) adaptive behavior; (d) personal social behavior.

CHILD PSYCHOLOGY



COURTESY CLINIC OF CHILD DEVELOPMENT, YALE UNIVERSITY

CHILD DEVELOPMENT SHOWING GROWTH OF PELLET PREHENSION

1. The infant at 20 weeks stares at a pellet 7 mm. in diameter. He is unable to move it at will. 2. At 24 weeks the infant can envisage the pellet with head erect. 3. At 28 weeks he is able to reach out and touch the object at will. 4. Without supporting his body with his arms, at 32 weeks

the development of prehension is well advanced. 5. At 40 weeks prehension, or ability to grasp an object at will, is approaching maturity. 6. At 52 weeks the infant grasps the pellet between forefinger and thumb, completing in early type of development showing adaptability to environment.

level is without adequate support, and is fantastic in its extreme form. Biologically infancy is a period of plastic immaturity, which in the human species provides large determination of behavior through the impress of experience, but on the basis of genetic racial trends, and individual, or temperamental and constitutional, inheritance. The prolongation of human infancy is a biological condition of the plasticity of adult behavior patterns on which education in large measure depends.

Instinctive Trends and Habit-Formation. The earliest stages of the child's development proceed upon instinctive trends. These are at first crude, the earliest of them transitory, and many delayed in appearance. (See *Instinct*). These trends are reinforced, or checked, and modified by training, which provides ampler means of expression, substitute outlets, and selects desirable types of response. The course of eating, playing or speaking variously illustrates the process. That this course parallels or rehearses the biological and sociological development of man is held by the theory of recapitulation. The theory applies slightly if at all. Children do not climb trees or swim because their biological ancestors did so, nor do they play at being Indians or outlaws because these modes of life are represented in sociological history. They choose from available patterns of action those that give satisfaction to their growing urges. That they are directed by pleasure and pain, by experience of ability and increasing command, by artificial rewards and punishments, is abundantly clear. There is a progression from fundamental to accessory activities, from cruder to refined coordinations.

Childhood Traits. Characteristic activities selected for special study are motor manipulation, fighting, possession, sociability, display and rivalry. Such combined processes and instruments of progress as suggestion, imitation, speech, or control through words, compose the psychological categories of delineation. Throughout attention must be directed to the emotional support, upon what satisfies and what annoys, and by appeal to what trends such pleasures and pains act; and to the intellectual stages of comprehension, which are summarized in the learning process. Motives and reasons for behavior appear as the infantile stages of instinctive impulse are outgrown. The direction of interest which determines what kind of stimulation becomes a stimulus, is a serviceable clue throughout; it is as important as the manner of the response. These terms supply the S-R of the stimulus response theory, which is always to be considered as an S-O-R process or unit of behavior, the "O" representing the general and individual trend of the organism, determining in some measure what shall act as S, to what order of R it shall lead.

Methods of Approach and Results. Child psychology proceeds by several methods by tracing the genetic course in the unfolding of the several orders of mental mechanisms; by following the stages of each distinctive function or habit pattern from initial to complete stage; by attempting an integration of levels

of development. Under the first head is the familiar finding of the early development of the sensory perception and memory of children. In the direction of their interests, as for boys in distinguishing the various models of automobiles, they make distinctions readily. That childhood is the favored period for learning languages by ear is equally familiar. The very young child detects a change of phrase when a story is read to it, childhood imagery is vivid, so much so that a name, eidetic, has been given to the intensive imagery of exceptional youths. Children visualize more, and use concrete imagery; they believe in imaginary companions; they confuse thrilling fabrication with reality; they are dramatic and pictorial in their mental set. Judgment and facility in handling the abstract develop later. Under the second head are such specialized studies as those of Piaget, *The Language and Thought of the Child*, 1926, and *Judgment and Reasoning in the Child*, 1928. The child's language is at first dominantly ego-centric, for self-expression, it tells what it is doing or desires. Communication increases gradually; description comes still later. The increasing vocabulary and command of phrase and construction as well as of the ideas expressed remain the most comprehensive index of mental progress.

The child's mental growth appears in its notions of cause and effect, the "whys" it asks and the nature of the explanations that satisfy at different ages. A parallel progress is traceable in the plays and games and toys of children. The third order of inquiry correlates motor and mental with social and moral development and converges upon the comprehensive integration called *PERSONALITY*. This is the cross-section method using the contrast between an earlier and a later stage, as Gessell does for infancy, or Norsworthy in contrasting the life of a child at five and at eleven years of age. In this field, distinction of types becomes important, the shrinking and the aggressive child appearing in the extroverting and introverting tendencies, while the moral aspects of behavior assume commanding importance. Children must be socialized and moralized, as well as made strong and capable and sufficiently informed to find and make their way in the world.

Growth by Expression. The intellectual progress of the child finds its recognition in the arrangement of school studies. Interest, general and special capacity, and grasp of concrete processes and abstract relations furnish material for the psychological growth as well as for the educational program. (See *CHILD AND YOUTH, GUIDANCE OF*). In this field a special emphasis has recently been directed to the creative intelligence, or cultivation of the imaginative spontaneity characteristic of the child mind and readily lost in the imposed discipline of set patterns of solution.

Of the two tendencies which inhere in the human species by reason of its gregarious nature, the tendency to lead and the tendency to follow, either may be too dominant, giving rise to the contrast of the too aggressive and the too submissive child. In the intel-

lectual field the parallel distinction is between the too individual, and the too conforming, imitative trend. It is not accidental but inherent in child psychology that the same period is characterized by the marked development of spontaneous imagination, creating its patterns by following the trends of its own interests, and also by a pronounced suggestibility and imitativeness, which latter is an expression of child dependence.

Growth proceeds by active expression, however much passive reception is indispensable. Learning is both acquiring and expressing. The evidence of creative intelligence among children, in art and literature especially, is convincing. Composing prose and verse in story and drama, acting, impersonating, project forming, making scenery and properties for plays, the various arts and crafts, musical expression, all present the opportunity of combining original expression with accumulation of knowledge by assimilation. As the young child learns almost entirely by doing, that outlet must continue to be supplied in the later stages of the growth process.

The Problem Child. A chapter of importance in recent child study that contributes notably to child psychology considers the problem child. While it remains true and important that the great majority of children are normal, even normal children show the trends that appear in accentuated form in the problem child. These deviations appear in infancy and early childhood. Irregular sleep, resistance to food and the development of food whims, habit spasms, including finger sucking, excessive tantrums and night terrors, negativism or contrariness in doing the opposite, resentment to discipline, become symptomatic of a nervous condition. The two orders of problem child the anger type, aggressive, unruly, enterprising, individualistic, and the fear type, timid, shrinking, hesitant, easily alarmed and seeking protection, are fairly distinctive, despite the fact that many nervous children show some symptoms in each group. Both are affected by the general distinction between children who live on a low emotional level and those who live intensely with a high degree of tension, the relatively phlegmatic and the relatively excitable. The patterns of work and fatigue are equally characteristic.

The problem child appears in deviations from desirable norms, notably in the direction of resistance to discipline, resentment, unruly violence, cruelty, solitary withdrawal, refusal to enter into team play and social competition, moodiness, sulkiness, continuance of babyish reactions, perversions, and tendencies that later express themselves in truancy, delinquency, and anti-social behavior generally. Dr Wile in *The Challenge of Childhood*, 1925, divides these personality problems into physical, intellectual, emotional and social cases, giving illustrative case histories, according to which factor dominates as a handicap or source of deviation. In response to the special needs which these children require in direction and treatment, clinics for problem children have arisen, and the services of a consulting psychiatrist are made available in

schools and institutions as well as in social centers. The problem child in later years may be the result of a problem family situation complicated by psychological peculiarities.

Attention has likewise been directed to the exceptional or superior child. These studies have yielded interesting generalizations supporting the view that the several directions of superiority are correlated. Despite special gifts which may occur in the absence of high ability, the gifted child is superior generally, including superiority of physique. They show further the relation of precocity as a sign, though not an invariable one, of future distinction, which conclusion combines with that of the predictive value of early and late scholastic standing as an index of mature career. At this and many other points the data of child psychology provide the principles for the guidance of training and its adaptation to the individual capacities and temperamental type.

The Freudian view of the problem child makes pivotal the relation between child and parent, either by way of too intense fixation or revolt. The Oedipus complex is regarded as thus originating. The too intense fixation on self is called Narcissism. That the Freudian component plays a part in the psychology of problem children is undoubted. An inclusion of this view would unduly extend this article. See *ADOLESCENCE; CHILD AND YOUTH; GUIDANCE OF*. J. J.

BIBLIOGRAPHY—Norsworthy and Whitely, *Psychology of Childhood*, 1918; Miller, *The New Psychology and the Teacher*, 1922; *The New Psychology and the Parent*, 1923; *The Children's Foundation, The Child: His Nature and Needs*, 1924; Baldwin and Stecher, *The Psychology of the Pre-School Child*, 1924; H. C. Cameron, *The Nervous Child*, 1924; Thom, *Everyday Problems of the Everyday Child*, 1927; Maccart, *Just Normal Children*, 1929; Ashitt, *Psychology of Infancy and Early Childhood*, 1930; F. J. Switt, *The Psychology of Childhood*, 1930; Rand, Swenck and Vincent, *Growth and Development of the Young Child*, 1930; Murphy, *Experimental Social Psychology*, 1931.

For studies on superior children, see Hollingworth, *Gifted Children*, 1926, and the elaborate studies by I. M. Terman and Cox, *Genetic Studies of Genius*, 1926, and *The Promise of Youth*, 1930. For backward children, see Holmes, *Backward Children*, 1915.

CHILDREN, DISEASES OF. Disease in childhood differs from disease of adults. Infants are exquisitely predisposed to a variety of infections, and also they are subject to various anomalies of growth and development.

PRENATAL DISEASES AND DEFORMITIES

The fetus during its intra-uterine life may be affected by disease which it contracts from the mother. *Infections* may pass from the mother to the fetus, as for example, typhoid fever, smallpox, pneumonia, malaria and syphilis. The fetus may contract typhoid, recover *in utero* and may be born full-term, or a fetus may contract the disease and be born alive, prematurely, with the disease in progress; or the fetus may contract the disease, perish *in utero* and be expelled prematurely. It has been stated that mothers suffering from typhoid fever, tuberculosis, or septicaemia may give birth to offspring who are deformed.

ECLAMPSIA or toxemia of the mother during pregnancy may cause premature birth, debility, CONVULSIONS or death of the infant. (See also EPILEPSY.) From a study of babies born of toxic mothers, it is learned that the infant mortality during the first days or weeks of life is materially increased.

Certain drugs may pass from the mother into the body of the fetus, such as mercury, phosphorus, arsenic, copper, chloroform, ether, morphine, lead, and alcohol. *Lead* and *alcohol* among the drugs, and *syphilis*, among the infections, may be cited as agents which, when introduced into the fetal body, may cause definite disease conditions that may persist and be recognized even after birth. *Lead*, for example, may affect the nervous system or the kidneys. Aside from the actual congenital syphilitic disease, which is recognized after birth, there are those who believe that syphilis and alcoholism in the progenitors may produce deformities in the progeny, such as retardation of stature, abnormally small skull and brain, hare-lip and cleft palate, and a great many other developmental defects.

It is not definitely known what the causes of the various *deformities* and *monstrosities* may be. As has been mentioned, syphilis and alcoholism may sometimes be considered causal, though these noxious agents cannot always be held responsible. Indeed, infantile malformations may arise in the offspring of healthy parents.

Nearly every tissue and organ of the body of the newly born baby may present some defects in growth or development and constitute a malformation. Heredity sometimes plays a part in these organic defects. Succeeding generations of babies are seen, with webbed fingers or webbed toes, also those who are congenitally deaf.

The child may be born with some malformation of one or both eyes. Indeed, he may be blind from birth. Among other malformations may be mentioned defect in the formation of the skull, monstrosities of various kinds, such as joined twins, congenital disease of the heart, hernia into the umbilical cord with the intestines lying in the thin sac, hydrocephalus, microcephalus, and spina bifida. The esophagus may be impervious, constituting so-called stenosis. Indeed, the intestinal tract throughout its entire course may be narrowed in one or more places to the extent that it is impervious.

The pyloric end of the stomach is sometimes thickened or the muscular coats are permanently swollen, so that the food may pass imperfectly into the upper intestine. This causes vomiting, loss in weight, and, unless this condition is relieved, a fatal outcome may be expected. Spasm of the pylorus, which is difficult to differentiate from the so-called hypertrophic stenosis alluded to, may cause similar, though not such severe symptoms. The anal orifice may be closed at birth, and unless the infant is relieved by operation, death is inevitable. A defect in the diaphragm will permit the intestinal contents to locate in the thorax and in some instances interfere with normal function.

CLEFT PALATE and HARELIP may occur singly or associated. An incomplete development of the bladder and the abdominal wall may result in a so-called exstrophy of the bladder. The male as well as the female genital organs are subject to numerous malformations. Among those commonly observed are the undescended testicles or malposition of the external urinary opening. It may be above the normal site, known as epispadias, or below, known as hypospadias. The female genitalia are also subject to numerous malformations, the commonest being imperforate hymen. Hermaphroditism may occur, the accurate diagnosis of which depends upon the proof of the existence of the gonads of both sexes in the same individual.

There are malformations of the extremities, such as webbed fingers, webbed toes, club-feet, congenital dislocation of the joints, curvature of spine, certain types of dwarfism and other deformities of the bones. Indeed, one can hardly think of any organ of the body without considering some possible congenital malformation or defect.

INJURIES AND DISEASES OF THE NEWBORN

Accidents and Injuries Resulting from the Act of Birth. The life and the health of the human individual is not only in jeopardy before birth, but it is menaced in certain ways by the act of birth itself. A long, difficult labor, instrumental delivery, a rigid birth canal, which delays the expulsion of the baby's head and subjects it to great pressure is likely to result in such injuries of the skull and its contents as hemorrhage into the coverings of the brain or into the brain substance itself, which may in turn cause immediate CONVULSIONS, resulting in death, or, if the infant survives, may cause paralysis or mental deficiency. Injuries of the bones may also occur, such as fracture of the skull, clavicle, ribs, or long bones. (See also ENCEPHALITIS, LETHARGIA, PARALYSIS.)

Diseases of the Newborn. A newly born baby presents certain unusual phenomena, which in the infant are considered normal.

There is an initial loss of weight which averages roughly from 6 to 9% of the absolute body weight. Jaundice of the newborn is usually first observed on the second or third day of life and disappears ordinarily by the end of the first or second week, without causing any disturbance of health. Of course, in this connection rare cases of congenital obstruction of the bile duct, inflammatory disease of the liver and septic infections, where JAUNDICE may indicate a severe if not a fatal disease, are not included.

There is a desquamation of the skin which occurs in nearly every newborn baby. Ordinarily this occurrence is of no serious consequence, but when the desquamation is excessive and penetrates into the deeper layers of the skin, infection may occur into this denuded area and the process is no longer physiologic but constitutes a diseased condition.

Occasionally there is a swelling of the infant's breasts with an actual secretion of milk ("witches milk"). It is thought that substances from the

mother's blood (hormones) enter the child's circulation through the placenta and cause the enlargement of the infant's breast and the secretion of milk, which is a physiological process. Albumin may be temporarily present in urine of newly born children. The blood is richer in hemoglobin and cellular elements than at any other period of life.

New-born infants become easily infected. *Infection* may occur through the open umbilical wound, through an abrasion of the skin or through abrasions of a mucous surface. In the older individual such an infection usually becomes localized, but in the newborn it frequently becomes general. This failure to localize an infection in the newborn is probably due to the immature development of its powers of resistance.

The resistance of a baby or its reaction to bacterial infection depends on the state of its nutrition. Only the completely healthy, well-nourished infant, resists in an ideal manner, bacterial invasion. During the first year of life mortality in breast-fed infants is much lower than in artificially fed infants. A complete state of normal nutrition is the best safe-guard against infection.

The *eye* is a frequent site of infection and the gonorrheal type of inflammation (ophthalmia neonatorum) may result in serious scarring or loss of vision. (See also BLINDNESS, MEDICAL ASPECTS OF; GONORRHEA.) It has been estimated that 25 to 30% of blindness in adults is due to this infection. A 1% nitrate of silver solution, after the method of Crede, should be instilled into the eyes of every newborn infant immediately after birth to prevent this disastrous and dreaded infection. (See also EYE, AFFECTIONS OF.)

Infections of the *mouth* are commonly observed in young infants. Thrush is a disease of the mucous membranes of the tongue and mouth, characterized by the formation of white patches which adhere firmly. It frequently occurs in nurseries for the newborn and is due to a yeast-like organism. The infection may be prevented by practicing aseptic methods.

The Healthy Baby. The healthy baby, as soon as he becomes a member of society, is usually a happy mortal. During the early part of his life, he sleeps almost continuously, awaking only to get his food. He gains steadily in weight and has a normal temperature. He has a fresh pink skin that is firm and elastic to the touch. Such a baby is uncomplaining. He has a keen appetite, normal evacuations from the bowels and kidneys and is not irritable, cross or whining. Being, however, a delicate and undeveloped organism, he must be carefully protected against disease, particularly against bacterial infections to which he is readily susceptible. This is due in part to the fact that the skin and mucous membranes are delicate in texture and are readily torn or abraded.

Premature Infants. It is a disadvantage for a baby to be born prematurely. If he had remained longer *in utero* he would have been protected from all injurious influences and would have undergone a more complete development. The premature baby is under-

weight and underdeveloped, and its chances for surviving are less than for a full term baby. Those premature babies who weigh less than 500 grams or 3½ pounds are difficult to rear. The premature baby, under all circumstances, is feeble and delicate. The cry is weak and whining. The infant sleeps almost constantly. The skin is covered with fine hairs, so-called lanugo. The finger-nails are short and do not reach to the finger-tips. Among other things, these children have a poorly developed temperature regulating mechanism. They are difficult to feed. Many of them show respiratory embarrassment which may lead to a bluish discoloration of the skin or mucous membranes. They show little resistance to infections, coughs and nasal disorders.

DIGESTIVE AND NUTRITIONAL DISTURBANCES OF INFANCY

Digestive Disturbances of Infancy. Digestive disturbances of infancy are comparatively frequent. They are more common in bottle-fed than in breast-fed infants. In a broad way, these disorders are spoken of as disturbances of nutrition. Digestive disorder is accompanied by general constitutional symptoms such as fever, prostration, loss of appetite, drowsiness, colics, and abdominal distention. These attacks in infants may be due to overfeeding or administration of unsuitable food or sometimes to an infection somewhere else in the body, such as an infected throat, tonsilitis or a middle ear abscess. Excessive heat, such as the hot days of the summer, may diminish the function of digestion. In other instances the infant may be underfed, causing restlessness, sleeplessness, constipation, and even diarrhea. If the accessory food sustenances or vitamins are not given in sufficient quantities, deficiency diseases may develop.

Vomiting and Diarrhea. Infants and young children suffer from a variety of nutritional disturbances, which for convenience of description may be classified as follows: First, babies who fail to gain, though they have no diarrhea and no vomiting; second, those who vomit without diarrhea, and third, those who have diarrhea with or without vomiting.

In that group characterized by *stationary weight without diarrhea*, the condition is usually due either to underfeeding, that is, an insufficiency in the quality or the quantity of the food, or to an improper composition of the milk preparations. Very often the carbohydrate or sugar is deficient in amount or the fat may be excessive; or some constitutional disturbance may interfere with the normal processes of nutrition, retarding growth and development.

Where the symptoms of diarrhea or vomiting are present, associated with elevation of temperature, digestive disturbance is usually present due to some *dietary faults*, either in the quantity or quality of the food, some error in its preparation, spoiled milk, excessively hot weather or an infection of the gastrointestinal tract. We know that during the warm weather and in certain localities, babies, like adults, may become infected through milk, water or other

foods with dysenteric diseases, which are due to a group of well-recognized bacteria. These diarrheal infections are usually severe and may give rise to the gravest local and general symptoms and are dangerous.

Not all of the severe diarrheas are due to infections. So-called *alimentary intoxication* may develop from previous mild digestive disturbances due to improper quantity or quality of food. The alimentary intoxications, in addition to the symptoms of diarrhea and vomiting already enumerated, are characterized primarily by the great loss of water from the tissues. This dehydration causes a number of symptoms such as sudden loss of weight, depression of the fontanel, sunken eyes, dryness and inelasticity of the skin, unconsciousness, and fever. The infant is prostrated. The evacuations from the bowels are very frequent, ejected with considerable force, watery, and colorless. The smallest quantities of water and milk are immediately vomited. These infants are particularly subject to secondary infections. These infections may be mild or severe, though they should always be taken seriously, and require most careful medical supervision. In another group of alimentary disorders the most outstanding symptom is the loss of weight and particularly the disappearance of the subcutaneous fat, and subcutaneous tissues. The babies have lost their tolerance for food, and it is no longer possible to nourish them adequately. In some of them diarrhea occurs, but not infrequently they have hard, dry stools. This condition is spoken of as atrophy or marasmus. (See also DIARRHEA.)

Rickets. Rickets is a disease of infants and young children, and is a nutritional disorder which occurs at a time of life when bone development and bone growth is at its highest peak. It occurs more frequently in bottle-fed than in breast-fed babies. It is characterized by a disturbance in calcium metabolism, that is, an insufficient amount of calcium is appropriated by the growing bones. In consequence of this, the bones remain soft and fragile. Rickets is most pronounced from the fourth month to the second year of life. It is believed that a diet deficient in vitamin D, with an insufficient exposure to sunlight and other contributory factors such as improper food and unhygienic surroundings, tends to produce rickets.

Rickets may be recognized in its first stages by restlessness, sweating and abnormal changes in bones. The flat bones of the skull may be soft and compressible (cranio-tabes). There are knob-like elevations at the junction of the bony with the cartilaginous portions of the ribs, which are called the rachitic rosary. There is a thickening of the bony structures in all the long bones where the shaft joins the cartilaginous end of the bone. This is seen most plainly at the wrist. The closure of the fontanel is delayed. The forehead is unusually prominent. The head is frequently square. The teeth erupt late and irregularly. Deformities in the lateral portions of the chest with flattening and depressions as well as bow-legs and knock-knees are not infrequently observed. The static functions of these children are delayed; they

learn to sit and walk late. The prevention of rickets consists in starting the baby on breast milk, securing fresh air and particularly sunlight and administering, early, cod liver oil and the newer remedy, viosterol. (See also RICKETS.)

Infantile Scurvy (Barlow's Disease). This disorder is due to a deficiency of vitamin C in the diet. Vitamin C is contained in orange juice, tomato juice, citrus fruits and some leafy vegetables. The disease manifests itself by softness, sponginess of and hemorrhages into the gums, and particularly by hemorrhages underlying the outer layer of the bones. The legs are most frequently affected. These sub-periosteal hemorrhages cause great pain, and the motion in the affected part is consequently limited. Hemorrhages may also occur from the bowel, the kidneys, and sometimes into the orbit of the eye. It is a common practice nowadays to give every infant orange juice or some other vitamin C containing food as a preventive measure against infantile scurvy. This may be begun as early as the fourth week of life, especially in artificially fed babies. See also SCURVY; VITAMINS.

RESPIRATORY DISEASES

Grippe. Respiratory diseases are of frequent occurrence. Their most common manifestation in infancy and young childhood is the cold, or as it is sometimes called, *la grippe*. This disease may occur either epidemically or endemically. It is frequently carried by nurses, parents, or anyone suffering from a cold. The babies whom it affects suffer from catarrhal inflammation of the throat, nasal mucous membranes, larynx, trachea, and bronchial tubes. The infection may produce restlessness or drowsiness in infants. They frequently have gastro-intestinal symptoms, such as vomiting, diminished tolerance for food and loss in weight. These symptoms, however, are present without any intestinal lesions. *La grippe* is frequently complicated by more severe respiratory diseases, such as bronchopneumonia; other complications which may occur, are middle ear infection, kidney infection, meningitis, valvular heart disease, peritonitis, and sometimes pyelitis (pus in urine).

The most important factor in the treatment of grippal disorders consists in their prevention. The baby should be protected from other children and adults who are suffering with catarrhal symptoms. He should be fed and cared for in such a way that his resistance to disease shall be maximal. He should be properly clothed and kept in well-ventilated apartments or out of doors, when the weather permits. If he falls ill, he should be kept in a well-ventilated, moderately warm room. He should be kept quiet. Nourishment should be continued if the patient is able to take it. The baby should not be depleted by the excessive use of cathartic drugs. Medical treatment should be instituted only when it is indicated or advised by the medical attendant. (See also INFLUENZA.)

Croup. Croup is a disease characterized by laborious and suffocative breathing, laryngeal spasm, and

sometimes with a local membranous deposit. Croup depends upon a diseased condition of the larynx.

Catarrhal conditions of the larynx occur during various respiratory infections, such as influenza and measles. On account of the narrowness of the infant's larynx inflammation and swelling may lead to obstruction of breathing.

The symptoms of croup are: hoarseness, hard rasping cough, burning pain and tenderness over the larynx with fever. The throat is usually red and an examination with a laryngoscope shows the epiglottis and the vocal cords red and inflamed. The inflammation in the larynx spreads to the mucous membrane below the vocal cords. The patients show marked difficulty in breathing, awaken during the night with a suffocating sensation and hoarse cough and voice. Their expression is one of anxiety, the skin may become blue, and retraction of the soft parts of the chest, including the intercostal spaces, the upper and lower parts of the sternum.

Croup may be due to the invasion of diphtheria into the larynx; a membrane is formed which may spread rapidly and cause partial or extreme obstruction. The most essential point in the treatment is the early and liberal use of diphtheria antitoxin. It may be necessary to place a tube in the larynx to relieve the suffocation.

For the ordinary croup, such as occurs in catarrhal conditions, hot drinks, steam inhalations, hot applications over the larynx and sedative remedies to control restlessness and fever should be employed. (*See also* Emetics.)

In all such cases it is important to consult a physician who will determine whether the disease is diphtheritic or catarrhal in nature.

Bronchitis, which is a frequent occurrence in young infants and children, develops in association with many of the acute, infectious diseases, notably with measles and whooping-cough. It gives rise to very definite signs and symptoms, the most prominent of these being cough, fever, and the so-called râles, which, on examination, are heard diffusely distributed over the lungs. When bronchitis confines itself to the larger bronchi, it is rarely ever severe. When, however, the pathological process extends into the smaller bronchi, producing inflammation in the bronchioles, it develops into capillary bronchitis, or bronchopneumonia. (*See also* BRONCHITIS.)

Pneumonia. The pneumonias of young life may be caused by a variety of bacteria, though the pneumococcus is most frequently identified. *Lobar or croupous pneumonia* is an inflammation of the lungs which attacks a whole lobe. It may occur at any age, though as a rule it is found in older children and adults. It begins suddenly and most often terminates in seven or nine days with a sudden fall in temperature, the so-called crisis. The mortality is not as high as in bronchopneumonia, which is more frequently in young childhood. Complications of lobar pneumonia may protract the disease or give rise to alarming symptoms.

Bronchopneumonia, also called *lobular pneumonia*, is the most frequent variety in the extremes of life, infancy and old age. It usually develops gradually, being preceded by a bronchitis. In a short time the finer bronchi and the alveoli become inflamed. The disease may persist for several weeks, characterized by fever, prostration, cough, and unusually rapid breathing. The facial expression is anxious, and indicates suffering. The supply of oxygen is diminished and the child becomes dusky or blue. The cough disturbs the patient day and night. The patient refuses food and is difficult to nourish. Newborn babies and premature infants are sometimes attacked and are rendered critically ill by this infection. Indeed, the mortality from pneumonia among the newborn is very high. (*See also* PNEUMONIA and RESPIRATORY SYSTEM, DISEASES of.)

For tuberculosis in children, and vaccination against this disease, *see* TUBERCULOSIS.

INFECTIOUS DISEASES IN CHILDHOOD

The acute infectious diseases appear suddenly in a child in the best of health, and disappear rapidly. They may resolve in a relatively short period with complete recovery, or the cure may be delayed by various complications. SMALLPOX, MEASLES, SCARLET FEVER, DIPHTHERIA, CHICKEN-POX, WHOOPING COUGH, MUMPS, INFLUENZA, INFANTILE PARALYSIS and epidemic MENINGITIS are acute infectious diseases. The chronic infectious diseases, such as tuberculosis and syphilis, begin gradually and it is several weeks sometimes before they are recognized and a long period intervenes before they are cured, if cure is possible.

Incubation Period. In all infectious diseases there is an incubation period which is the interval from the moment of infection to the time when external manifestations are first noted. Thus the incubation period may be very short (1-5 days), as in scarlet fever or diphtheria; or of moderate duration (5-10 days), as in infantile paralysis, or there may be a long incubation period of 10 days or more, as in smallpox, mumps and measles.

Transmission. Transmission occurs in various ways. In many infectious diseases, it presumably occurs through the air, as in chicken-pox, smallpox, or measles. In others, as TETANUS, infection occurs by direct contact through an abrasion of a protecting body surface. Other possible ways of dissemination are by dust, water, food, and insects, or by the hand, or clothing of a third person who has recently been in contact with a patient suffering from an infectious disease. A frequent mode of dissemination is through so-called CARRIERS OF DISEASE, who harbor the infectious agent. This includes those individuals who, perhaps, actually had the disease in a mild, unrecognized form; those who have recovered but still harbor the active infectious germs; and those who have sufficient immunity to be prevented from acquiring the disease, but do carry the specific infectious agent.

Immunity. Individuals having either a natural or acquired IMMUNITY against specific infectious dis-

eases will not contract the disease when exposed to it. This immunity or protection may be inherited (natural immunity) or it may be conferred by an attack of the disease (acquired immunity). The latter may also be induced artificially by the use of vaccination, vaccines, antitoxins and serums. (See ANTITOXIN; SERUM THERAPY; VACCINATION.)

In the prevention of the infectious diseases of childhood educational, social, and hygienic measures must be vigilantly employed by the medical profession and all public health organizations in order to prevent the spread of these diseases.

FEVER IN CHILDREN

Fever is as important and prominent a symptom in diseases of infancy and childhood as it is at any later stage of life. Infants and young children show relatively higher temperatures than adults when reacting to an identical infection. In acute infectious processes the child may have a temperature ranging from 105°-107° and yet recover. In some children the temperature elevations are always higher than in others of the same age and weight. This difference is a matter of individuality and is dependent upon the nervous constitution, strength and general resistance to infection. (See also FEVER.)

The cause of fever in infancy and childhood is sometimes obscure and it may be protracted for weeks without offering any indication of its origin. In these instances careful and repeated physical examinations of the visible mucous membranes, ears, heart, lungs, abdomen, nervous system, and skin, must be carried out, supplemented by proper laboratory examinations. Occasionally there are instances of a persistent low grade temperature, associated with no apparent disease process and merely an expression of individual variations in heat regulation. Persistent low grade temperature in young life may be dependent on some functional instability of the heat-regulating mechanism and not due to any organic disease.

For diseases of the heart in children, see PERICARDIUM, DISEASES OF; RHEUMATIC FEVER.

I. A. A.

CHILDREN, LAWS RELATING TO. Regulations for the protection of the health and morals of infants usually concern themselves with employment, cruelty to and enticement of children, and forbidding the allowance of minors in certain places, such as saloons and gambling centers. Limitations upon employment of children are the most frequent, restricting the possibilities of gainful occupation to infants beyond a specified age and to work that is not injurious to health or morals. (See CHILD LABOR.) Many states provide for probation officers who aid courts in exercising proper control and custody of children and are in effect guardians for children brought into court. Statutes in some states authorize the organization of societies to care for dependent and neglected children and for the prevention of cruelty to such children. Minors without parental

care are considered wards of the state, it having power to provide for their support. In some states provision is made for periodic payments to indigent widows or abandoned mothers for support of their children in their own homes. (See PENSIONS, MOTHERS AND WIDOWS.) Compulsory education laws are universal.

N. G.

CHILDREN'S COURTS. Specialized legal treatment for children is old in the COMMON LAW, children being regarded as wards of the court. But in the United States, early in the 19th century, numerous instances of severely cruel treatment of infant offenders provoked agitation for modification of court procedure in the trials of child offenders or delinquents. In 1825 a house of refuge was established in New York; the example was shortly thereafter followed and elaborated in Pennsylvania, Massachusetts, Illinois and Michigan. In 1899 the first juvenile court in the world was established in Chicago; to-day every state in the United States, except Maine and Wyoming have such courts. The chief distinguishing features of juvenile courts are: children's cases are to be heard at different times and preferably in a different place from those of adults; children are to be detained in separate buildings and if commitment is necessary they are to be committed to special institutions; probation officers keep in constant touch with the children who have been before the court; the child is not to be taken from the parent unless necessary but parental obligations are to be enforced; court procedure must be informal; the purpose is not to punish but to save the child; the children are to be dealt with as persons in whose guidance and welfare the court is vitally interested. Recent trends in state legislation have been towards raising the age (now generally fixed at 18 years) at which children remain subject to the jurisdiction of juvenile courts; toward making the hearings more private and toward safeguarding the court records from public view. An adjudication for delinquency is not deemed a conviction for a crime. Though the early juvenile court statutes were challenged as unconstitutional the latter carefully drawn laws have been uniformly upheld. See also JUVENILE DELINQUENCY.

N. G.

See H. H. Lou, *Juvenile Courts in the United States*, 1927.

CHILDREN'S CRUSADE, a movement of children, connived in by unscrupulous adults, to retake Jerusalem. It appeared in France in 1212 under the leadership of one Stephen, a shepherd boy, who headed for Marseilles. Almost all, apparently, fell into the hands of the Mediterranean slave trade, then a flourishing business, both Christian and Moslem. A similar movement under a German boy, Nicholas, gathered 20,000 children and headed for Italy. Those who lived to get over the Alps fell into the hands of the slavers. Pope Innocent III made use of the movement as an example to adults when the collapse of his plans in the Fourth Crusade led him to preach another.

CHILDREN'S GAMES. From babyhood to maturity, the child's natural play instinct is satisfied by

games, distinguished from ordinary play by organization and definite rules. Games must be taught, either by other children or by adults; they begin with the simplest pat-a-cake type and sometimes become surprisingly intricate. Early games are largely imitative, sensory and motor; the imitative games, such as keeping house, teaching school and running a store, are near the line of unorganized, individual play. Though imaginative, they are basically mimicry. Slightly more advanced games involve running, hiding, dancing and going through a frequently repeated routine. The young child has a strong sense of rhythm and also of tradition. Repetition does not become monotonous. To this period belong many of the folk games which derive from all over the world and for which rhymes have often been handed down for countless generations. It must not be thought, however, that such games are entirely of peasant origin; the aristocracy of bygone centuries heartily enjoyed the games now thought childish. Queen Elizabeth's maids played tag in her gardens, and dancing games, rounds and forfeits were favorite pastimes of the highest English and continental society.

After about the seventh year, the child develops a clearer sense of rules and the competitive spirit. Games involving motor activity are still popular, and if "sides" are taken, the organization is loose and there is strong competition between individuals of the same group. In the ages of 10 to 12, an understanding of team play should develop. In this group, the violently active games reach their climax; games of daring, endurance and skill are far more popular than sedentary ones. At 13, the child enters the period of teams, clubs and advanced cooperative play, and soon the games cease to be childish and resemble those of adults.

Games of the younger period, some of which are soon discarded while others are played intermittently for years, include London Bridge, Blind Man's Buff, Going to Jerusalem, Drop the Handkerchief, and Puss in a Corner. Hide and Seek, Tag, Red Rover, Prisoners' Base and Duck on a Rock mark the next stage of active, loosely organized group games. The child who becomes interested in tip cat, baseball, hockey or other organization games is beginning to merge his play interests with those of adults.

Of late years, a realization of the psychological importance of a child's play life has led to the development of games to bring out desired traits, as strength, self-control, observation, mechanical skill or mental alertness. Basketball is the leading example of a game invented to exalt team play. Though children's games are many, their basic appeals are few, and only those which actually satisfy the play instinct are wholeheartedly accepted and passed from one child generation to another.

See George E. Johnson, *Education by Plays and Games*, 1907; Elliot and Forbush, *Games for Every Day*, 1926.

CHILDREN'S VERSE, poetry written especially for children. Children's verse originated in the 15th century with books of verse prescribing rules of conduct for noble children, as *The Boke of Curtesye*,

1460; but it was not till John Newberry published his *Mother Goose Melodies*, 1760, that verse was introduced for children's entertainment, and not until the 19th century that it had a wide vogue. Typical works of English origin are *Original Poems for Infant Minds* by the Taylor sisters, 1806; *Sing-Song* by Christina Rossetti; Robert Louis Stevenson's ever-popular *Child's Garden of Verses*; Walter de la Mare's *Peacock Pie*, 1916, and *Down-adown-derry*, 1922; and the current "Christopher Robin" series by A. A. Milne. Notable American children's verse has been written by Alice and Phoebe Cary in *Ballads for Little Folk*, 1873; Eugene Field in *Love Songs of Childhood*, 1896; James Whitcomb Riley in *Rhymes of Childhood*, 1895, and Kate Douglas Wiggin's and N. A. Smith's anthologies, *Golden Numbers*, 1909, and *Pinnafire Palace*, 1914.

CHILDRESS, a city in northwestern Texas, in the Panhandle, the county seat of Childress Co. It is situated near the Red River, 105 mi. northwest of Wichita Falls and is served by the Fort Worth and Denver City Railroad. Live stock and cotton-growing are the leading interests of the region, which also produces oil, gas, gypsum and gypsite. Cotton ginning, cottonseed oil manufacture, and refrigerating of produce cars are among the chief local industries. Pop. 1920, 5,003; 1930, 7,163.

CHILD WELFARE. Children and child welfare are of great importance in our national life. Great improvement has been made in the provisions for their education, health, recreation and protection, in the last few decades.

In 1880, the death rate in Massachusetts of babies under one year of age was 163 per 1,000 live births, and as late as 1915 it was 101. In 1928, 64 babies in Massachusetts and 69 babies out of every 1,000 born alive in the birth registration area failed to survive their first year.

Today the peak in the death rate is in the spring, not the summer. More than half of all the babies who die give up the struggle during the first month of life. Better living conditions have come with better wages; and better sanitation, better milk inspection and great improvement in medical practice have all contributed to this reduction. The education of parents and particularly mothers in the scientific care of their children and a more intelligent use of the knowledge and skill that the doctor has to offer is probably the most important single method by which this saving of life has been effected.

Every state now has some kind of compulsory school law, and a number have had fairly well enforced laws for many years. The compulsory program has developed new ideals for the education of children. The fact of universal attendance has required great changes in curriculum. It is individualizing instruction in a way unknown under the old system, and is also adapting school procedures to the great differences in children, both to their intellectual equipment and in the objectives for which preparation is sought. Education is no longer for the learned pro-

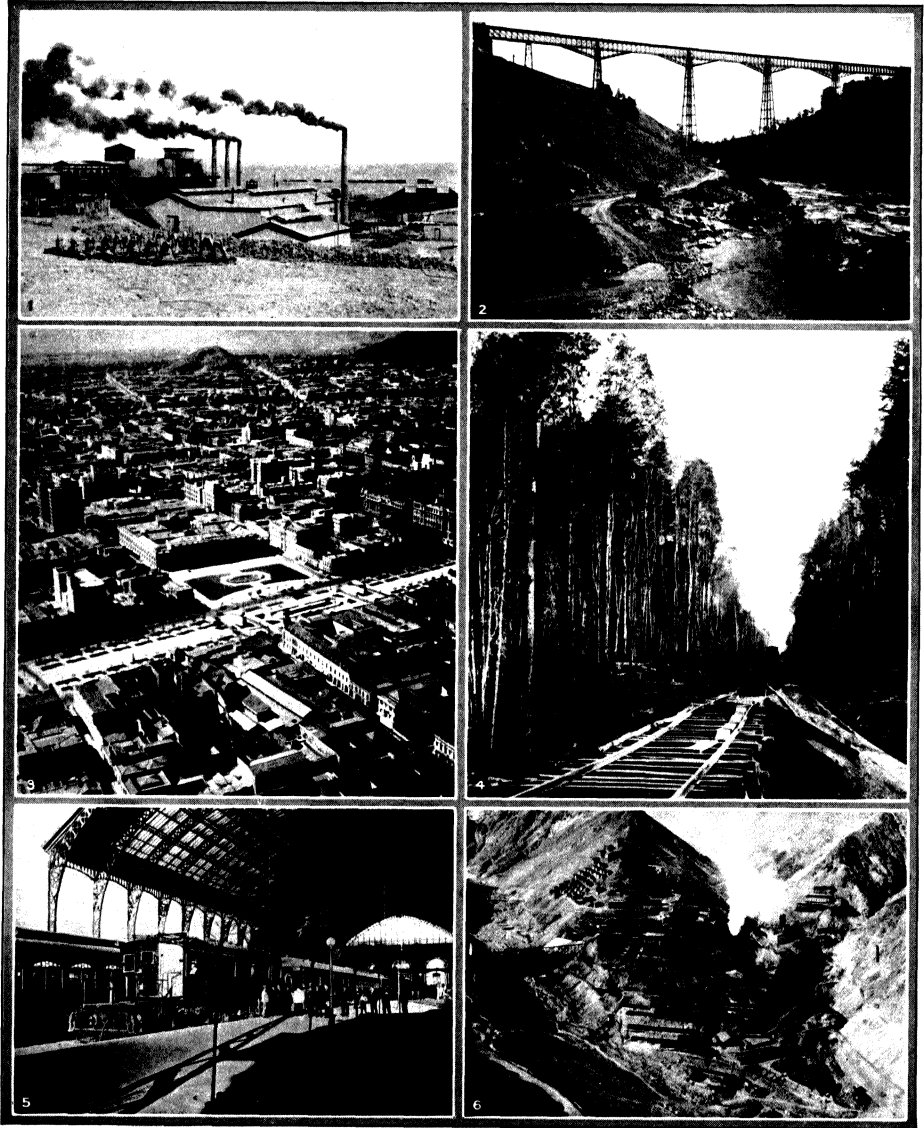
CHILE



MOUNTAIN SCENES IN CHILE

1. The Chilean army air field El Bosque, near Santiago, the Andes in the background.
2. Inca Lake, near the Trans-Andean railroad between Chile and Argentina.
3. Peaks in the Andes photographed from a plane flying from Buenos Aires to Santiago.
4. Mountain view in Aysen Territory, South Chile.

CHILE



COURTESY OF THE CHILE PAN-AM MAGAZINE, NEW YORK

INDUSTRIAL SCENES IN CHILE

1. Typical nitrate plant in the north of Chile. 2. Malleco Trestle, a high railroad bridge in southern Chile. 3. An air view of the business center and commercial heart of Santiago, the Chilean capital. In the center is La Moneda, government palace. 4. A logging track in the heavily tim-

bered lands of southern Chile. 5. Mapocho Station, Santiago, showing the electric trains which run to Valparaiso. 6. Mills and smelting-plant of the Braden Copper Mines, near Rancagua, 8,000 feet up in the Andes. Chile is one of the leading nations of the world in the output of copper.

fession only, but for business, for industry, for leisure, and generally for every aspect of life. (See also TRUANCY.)

Special training for the feeble-minded or subnormal is also provided. While discovering what the subnormal cannot learn, it has been found that they profit greatly by special types of training, and the kind of training that they can use is being provided.

Laws regulating or prohibiting child labor have made the enforcement of compulsory school attendance laws possible. These laws differ somewhat, but in general they fix age, educational and physical tests which the child must meet before he can secure a work permit, limit the working day of children and prohibit their employment in extra hazardous occupations. (See CHILD LABOR.)

Since 1880, a revolution has occurred in our ideas of JUVENILE DELINQUENCY and the treatment of the delinquent. We have passed the stage of enthusiastic statements of what the juvenile courts will be able to accomplish and are subjecting them to a searching examination of what they are doing and what they are not doing.

Recent research in methods of diagnosis and treatment has greatly increased our knowledge on this subject. The opportunities for clinical study which the so-called "habit clinics" and "CHILD GUIDANCE CLINICS" and the psychiatric clinics attached to courts have made possible, have been of enormous value.

The number of dependent children cared for by public aid has greatly increased, and there is a growing acceptance of the theory that, if the state does not itself undertake their care, it must assume the responsibility of knowing that reasonably intelligent and adequate care is provided. The change from the relative importance of private philanthropy to the growing importance of social economics and social politics in the field of child welfare has come about through many and widely differing causes.

At the same time, the standard of care by private agencies has greatly advanced. In 1900, relief as a whole, as conducted by leading public and private family welfare organizations throughout the country, was casual, temporary, intermittent and ineffective as compared with the work done by similar organizations today.

Our social theories are changing with respect to the founding and the child of illegitimate parentage, and the old belief that public morals were promoted by the suffering and moral ostracism of the children of the unmarried mother is disappearing. Laws recently enacted are clearly movements away from the old theory and toward the legal recognition that every child has two parents and that both of them owe to their children support, protection and education, in accordance with their ability (see ILLEGITIMATE CHILDREN).

It has been easier to reach a decision as to the course that should be taken in the case of children who are orphans, or half orphans, and are dependent merely because of poverty (see ORPHANAGES).

MOTHER'S PENSION or mother's aid legislation has been enacted in 45 states. The State has accepted the responsibility for the care of children whose fathers are dead or incapacitated and who are in need of assistance until they have reached the age of 14 or 16.

The best social work for dependent children who must be cared for away from their own homes is being done by agencies which are deciding, with the assistance of all the available resources, what is for the best interest of the individual child on the basis of a careful study of social background, physical condition and personality traits of the individual child; and they are now choosing a foster home or an institution.

See also CHILD HEALTH; DAY NURSERIES.

H. E. BA.

BIBLIOGRAPHY.—Fred S. Hall and Mabel B. Ellis, *Social Work Year Book, 1929, Reports of the White House Conference on Child Health and Protection*, The Century Co., 1930.

CHILE, a republic of South America, forming a narrow longitudinal strip of land stretching from the waters off Cape Horn at 56° S. lat. for a distance of 2,625 mi. to the tropical Tacna Valley at 18° S. lat., bounded on the north by Peru, on the west and south by the Pacific Ocean and on the east by Bolivia, Argentina and also the Atlantic Ocean washing on the Strait of Magellan. Final adjustment of the long-disputed Tacna-Arica question in May, 1929, gave Tacna to Peru and Arica to Chile, the line between them forming the northern boundary of Chile. The coast line is about 2,900 mi.; average breadth north of 40°, 100 mi; total area, 289,798 sq. mi. Pop. 1921, 3,774,485; 1931, 4,264,819.

Surface Features. The country is in essence a valley enclosed between two lines of mountains. On the east run the Andes, diminishing in height to the south where they are crossed by various rivers and lakes. On the west runs a parallel but lower coastal range, interrupted from about 42° S. lat. by many arms of the sea, but containing the long line of islands fringing the mainland. Between the two lies the rich and fertile longitudinal valley of Chile. North of 30° S. lat. this is continued by arid desert; south of 42° S. lat. it is largely submerged beneath the ocean. More than 70% of the surface of Chile is mountainous; only in the northern nitrate country, the central and coastal valleys of middle Chile, and along the Strait of Magellan do level stretches replace rugged terrain. The three well-defined geographical regions are the northern mineral region, the central agricultural valley and the southern forest and grazing district.

In the dry and mountainous northern half, between the coast range and the main Andes, there is a poorly defined valley interrupted by mountain spurs and peaks. From the sea the naked coastal range rises to heights of 4,000 to 6,000 ft. Beyond, a gently rolling surface of sands, gravels, bare rock ridges, pebble pavements, and salars, or salt-encrusted basins, stretches to the foothills of the Andes; here lie the great nitrate deposits. On the east, the Andes rise

in a broad and somewhat regular slope to an average elevation of 13,000 ft., culminating in peaks exceeding 20,000 ft., including ACONCAGUA and Mercedario. Of the many streams flowing down the flanks of the eastern mountains, less than six reach the Pacific; their waters evaporate or disappear in the deep and porous alluvial plains. Here the lack of exterior drainage has resulted in the great accumulations of nitrate and associated deposits. Between latitudes 19° S. and 28° S. in a distance of more than 500 mi. the only river to reach the sea is the Rio Loa, a permanent stream which furnishes irrigating waters for several agricultural districts, copper and nitrate camps and coastal cities. The aridity of the country is the most striking of its physical features. Nowhere does annual precipitation exceed 10 in. IQUIQUE records an average of one day of rain per year.

The second geographic province, the central valley, lies between the low coast range and the lofty Andes, together with the adjacent coast and contains about 90% of the inhabitants of the country. On the whole, the relief features of middle Chile fall into three major systems. 1. The coastal strip consists of small, fertile, transverse valleys, separated by comparatively rugged segments of coastal ranges. The rough lands rise to a maximum of approximately 7,000 ft., although the average is less than 1,000 ft. 2. Extending northward only to the vicinity of Santiago, the central valley comprises the rich piedmont alluvial plains at the foot of the coast range and the Andes. 3. The Andes constitute the most conspicuous though least utilized divisions of middle Chile. Their greatest value lies in enormous and as yet scarcely prospected mineral wealth and also in the waters which their heights provide for numerous streams used to irrigate the lowlands and provide hydroelectric energy.

The largest and least favorable portion of southern Chile embraces a stretch of almost 1,000 mi. It consists principally of the heavily forested slopes of the Andes, reaching an elevation of more than 10,000 ft., and the associated fringe of islands separated from the mainland by a maze of tortuous channels. Few strips of lowland exist. From the glaciers and snowfields of the mountains numerous sparkling streams plunge from deep valleys into the cold waters of the fiords, streams of no avail for navigation but promising a future storehouse of abundant hydroelectric energy. Adjoining the western section, the less heavily forested though more remote Patagonian depression adds another district of few habitations to southern Chile. Here rugged land predominates, but lowlands compose a much larger part of the total than in the coastal area. Northwestern Tierra del Fuego possesses a large part of the aggregate grazing area. The forest districts are rainy, damp and dismal, and discouraging to settlement. Precipitation annually exceeds 80 in. over the area.

Rivers and Lakes. The chief rivers, all in the southern half of the country, are the Maule, Imperial, Biobio, Valdivia and Bueno. Each is navigable by small steamboats. The Valdivia is the most impor-

tant because of the sheltered harbor at its mouth. In the south there are some deep lakes, including Llanquihue, 30 mi. long by 22 broad, and Ranco, 32 mi. by 18 mi.

Climate. The climate of northern Chile approaches that of the absolute desert. Winds not infrequently blow from the sea, but they bring rain only very rarely because of the cold Humboldt Current that skirts the shore, causing them to condense their moisture. Mists resulting from the condensation of moisture at sea are of very common occurrence in the summer months on the coast and at a moderate elevation inland, but these are not sufficient of themselves to support any continuous plant life. The lower levels are cooler than is usually characteristic of that latitude.

Central Chile, where the bulk of the population lives, enjoys a temperate and healthy climate. Like other regions with features of a Mediterranean climate, the northern lands of middle Chile receive the greater part of their rains in winter. The total annual rainfall is comparatively light. From less than 10 in. at La Serena, it rises to more than 50 in. south of Concepción. The drought brings the necessity for irrigation, and the relative abundance of winter snow in the mountains provides a store of water for summer irrigation. With more than 80 in. of precipitation per year and a comparatively uniform seasonal distribution, the climate of south middle Chile differs widely from that of the north. In the extreme southern part of the country the rainfall is excessive and almost continuous, and the winters are of antarctic severity.

Cities and Ports. SANTIAGO is the capital of Chile; VALPARAISO, the second city in population and the principal port; CONCEPCIÓN is the third city in size and commercial importance; VIÑA DEL MAR is the popular pleasure and seaside resort of Chile; Iquique, Talcahuano and Antofagasta are ports.

Inhabitants. The people are almost entirely of European origin; there are about 30,000 Araucans or natives in the mountains and an indeterminate number of nomadic Fuegians in Tierra del Fuego.

Flora and Fauna. Extensive tracts of northern Chile lie absolutely bare of plant life. The most developed stands of natural vegetation appear in the upper regions of the Andes. With the ascent of the mountains, moisture conditions improve, and in a zone of some 8,000 to 10,000 ft. a belt of short grasses forms a type of high pasture eagerly sought by the herders of northern Chile. The nutritious growths of the lower portions give way to types more alpine in character. The resinous tola bush provides a valuable fuel. In central Chile scattered forests appear. These consist largely of various species of beeches and laurels, together with a kind of cypress. Most of the timber has been cut, however, in the course of the four centuries of settlement, and the greater part of the fertile and sufficiently watered land is used for pastures and crops. The actual forested zone of Chile begins in the northern provinces of Linares

and Maule, and continues southwards to the Strait of Magellan where natural pastures predominate on the lowlands east of the mountains. The most valuable forests occur in the mountain section up to 5,000 ft., where Chilean pine (*Araucaria imbricata*) is fairly abundant. Elsewhere the stands consist mainly of beech, laurel and cypress. With the wide range of latitude and climate between Linares and Magellanes there is a natural substitution of one species for another towards the south, where Antarctic beech is the characteristic tree. The Chileans have recently been making vigorous efforts to develop their forest resources.

Middle Chile is distinguished botanically by its large numbers of indigenous species peculiar to the country. Among them are the *Francoaceae*, low-growing plants yielding a black dye and a sedative drug; the *Skytanthus*, a low shrub with yellow flowers; and several species of cactus. One of the most characteristic flowering plants is the *cophue* (*Lapageria rosea*) of which there are the red and white varieties; the flower is beautiful in form and color and lasts long after gathering. Fuchsias grow abundantly in middle Chile and on the lower Andine slopes. On the Strait of Magellan to the south, where proximity to the sea permits exploitation, a few sawmills operate and export a considerable amount of lumber principally to Argentina. Since the region has a broad latitudinal extent and much variety in altitude, the forests possess many kinds of stands. Various beeches, however, preponderate. *coihue* (*Nothofagus Dombeyi*) and *N. obliqua* constitute nearly half the growth. Associated with the beeches are the *cipres* or *cedro* (*Libocedrus chilensis*), fairly common in the mountains and in some lowland localities, and *alerce* (*Fitzroya patagonica*), which occurs principally in low, swampy lands. Southward the trees gradually become smaller, so that at the strait much of the forest is scarcely more than a scrubby area growing below 2,000 ft. Extensive grasslands occur principally on the southern heights. On the eastern slopes, the forest, here notably less dense, shelters a thick undergrowth of succulent grasses and shrubs. Tussock grass (*Poa flabellata*), various herbaceous flowering plants, ferns, mosses, lichens and numerous prostrate shrubs and bushy growths have furnished ample forage for sheep in the eastern depression and the territories about the Strait of Magellan.

The fauna of Chile is markedly different from the other countries of South America. Thus there are no monkeys, jaguars, river turtles and venomous snakes; lizards are hardly ever found beyond the northern arid zone. Fish are comparatively rare in the fresh waters but abundant in the sea, where seals, six species, and sea-otters are also found. Birds are numerous; among them may be named the Andine condor, represented in the national arms; the rhea or South American ostrich, parrots, humming-birds, swans, geese and ducks. The rodents include the beaver-like coypu, valued for its fur; the chinchilla,

with still more valuable fur; the *tuco-tuco* (*Ctenomys brasiliensis*); and rabbits and mice. The carnivora include the puma (*Felis concolor*), fox, wild cat and weazel. Among the ruminants are the guanaco or huanaco (*Lama huanacus*), which roams the uplands in large herds as far as Magellan Strait and the rare vicuna (*Lama vicunia*), both wild members of the llama family. The Indians hunt the guanaco, using its skin for clothing and also for covering the framework of their huts.

Agriculture. Although the relatively large population of Chile is dependent upon the cultivated area, food and feed crops occupy only about 8% of the land. Nearly three-fourths of the tilled area grows wheat, corn, barley, oats, alfalfa, clover, vetch, beans and potatoes, and vineyards occupy 12% of the total. For a number of reasons wheat is the principal crop, as climatic conditions are especially well-suited to its cultivation. Despite poor methods of tillage and harvest, the high yields, 18 to 28 bu. per acre, make wheat a valuable crop; it occupies almost half of the cultivated area in middle Chile. Indian corn, indigenous to Chile, is produced chiefly for forage. Fruit culture plays an important part in the agriculture of the northern section of middle Chile. The long growing season, free from extremes of heat or cold; abundant sunshine; deep, fertile, well-drained, sloping alluvial lands; and irrigation water applied when needed, all favor the production of a variety of sub-tropical and temperate fruits of excellent quality.

It is believed that the potato came originally from Chile and Peru; it is found wild in Chiloe and the adjacent islands and mainland. Beans and peppers are also indigenous, and maize and *quinua*, whether native or not, were certainly grown in the country before the Spanish Conquest.

Mineral Wealth. In early days the copper industry depended upon numerous small-vein mines of high-grade ore, deposits widely distributed in the coastal ranges and in the Andes. With the construction of the first reverberatory furnace, Chile gained means for the huge-scale production of copper, since the new method effected the smelting of sulphuric ores, of which the region has enormous stores. Various factors, such as the exhaustion of richer veins in the coastal zones, scarcity of labor owing to expansion in the field of nitrates, lack of transportation facilities and competition from United States copper, prevented growth in the 19th century following the first spurt succeeding the introduction of the new manufacturing process. In 1915, under the stimuli of war demands for copper and noteworthy technical improvements facilitating the utilization of lower grade deposits, the industry suddenly leaped into vigorous activity. In 1928 Chile was second among the countries of the world in copper output. At Chuquicamata, about 14 mi. north of Calama and 5½ mi. from the Antofagasta-Bolivia Railway, lie the most extensive copper deposits of the world. The greater part of Chuquicamata Hill, which covers an area of 2½ by ½ mi., consists of shattered rock so thoroughly

mineralized that the entire mass is considered workable ore. Huge charges of explosives, one in 1925 totalled 438 tons of dynamite and black powder which blasted more than 900,000 tons of rock, break into 11 different levels of the workings, and steam shovels load the ore into railway cars. The enormous production of Chuquicamata is made possible by the large-scale method of obtaining and handling the ore and by recovering the copper from oxide ores through leaching and electrolysis. Then the copper, melted and cast into bars of superior quality, commands a premium as a base for copper wire and electrical supplies. Annual capacity totals 187,500 tons yet the known and potential reserves of 688,000,000 tons of surface oxide and deeper sulphide ores, averaging 2.12% copper, are enough to last for a century at double the rate of production in 1930. The Potrerillos mine in the department of Chanaal is likewise an enormous enterprise of more recent development. A body of 100,000,000 tons of ore, largely sulphides, averaging 1.4% copper provide a reserve for a third of a century of operations on the present scale. Although there are dozens of copper mining companies in Chile, more than 90% of the metal is produced by two North American corporations.

The NITRATE industry is specially prominent not only among the mining activities, but also in the whole economic life of Chile. Huge beds of nitrates in the high pampas behind the coast produce about 60% of the world's supply, thus giving Chile a corner of the world's market and being a chief source of her wealth. The export trade in nitrates began in 1825, when 1,000 tons were exported. Between 1830 and 1900 the output doubled every 10 years. The exports in 1913 amounted to nearly 2,750,000 metric tons compared with just over 2,000,000 in 1908. The World War, though it brought temporary prosperity to the industry, has in reality been the indirect means of placing it in a critical position. The manufacture of synthetic nitrates in Europe and North America which had begun before 1914 had been greatly stimulated by the war, and synthetic nitrates, a by-product of the coke industry, are now serious competitors, by 1930 making up some 20% of the world's supply. The countries concerned, Chile, Germany and Great Britain, sought to take control of the industry and regulation of its prices into their own hands, when, on July 12, 1930 an international cartel, or combine, was incorporated, capitalized at \$375,000,000. Shortly afterwards, however, it was believed that international control had failed. Chile and her fellow members could reach no agreement on prices and the German government clapped a prohibitive duty of \$30 per ton on Chilean nitrates.

Various theories have been put forward to account for these Chilean deposits of nitrate. It is clear enough that the arid climate is one of the necessary conditions, otherwise the soluble salts would soon be washed into the sea. Since the caliche or nitrate-bearing material is found on the margins of salars in the lower part of the longitudinal depression, but

at a somewhat higher level than the common salt, it appears that nitrate, after being carried with the other salt by percolating waters into that part of the depression adjoining the coastal range, has then been redistributed by efflorescence. The caliche usually occurs several feet below the surface and naturally varies a good deal in the percentage of nitrate it contains. In five major districts the nitrate country extends in a long, much interrupted strip, 19° to 26° S. lat. See NITRATE.

Coal mining in Chile is confined to the southern half of the country. The best veins are those worked at Lota and Coronel, on the coast near Concepción. About 12 or 14 mines are operated, and the annual output is a little more than 1,000,000 tons. In quality the coal is a low-grade bituminous.

Iron ore is a second mineral of importance to northern Chile. After various attempts to develop a domestic iron and steel industry based upon local ores and the coal or wood in the south, the plants ceased operations, and the chief deposits of high-grade iron ore at Tofo, near La Serena, was leased in 1913 by an American firm. The completion of the Panama Canal made the Chilean ore deposits available for the steel industries of the United States, so that the Tofo district ships more than a million tons of ore per year, and in 1931 Chile held first place among the countries of South America producing iron ore. Gold and silver have long been worked in middle Chile, but the output is of little importance.

CHILE, HISTORY OF. Although remains are extant, including stones on which was inscribed writing that is yet undeciphered, which indicate a population and an occupation reaching back to remote times, the positive history of Chile may be introduced with the partial conquest of the country by the Peruvian Incas. The invasion is ascribed to the Inca Tupac-Yupanqui and occurred about the beginning of the 15th century. After several campaigns, Chile as far south as the Maule River was brought under Inca sway. Historians are not in agreement as to the extent of this jurisdiction; but the opinion is common that the mild rule brought the benefits of new industries, new methods of agriculture, exploitation of mines, better roads, improvement of culture, and changes in religion. The savage took on the rudiments of civilization. Weakened by civil dissension in Peru, the Inca rule in Chile after a century declined, and the local *Curacas* became virtually independent.

Hernando de Magellan or Magallanes was the first European to visit Chile; but the real conquerors were Almagro, Valdivia and Mendoza. Almagro, ill-used companion of Pizarro, misled by shrewd stories of a richer land than Peru, undertook the hazardous attempt to conquer Chile. Disappointed, he returned to Peru to become in 1537 a victim of the civil wars. The real hero of the conquest of Chile was Pedro de Valdivia, who from 1540-53 fought against man and nature with a valor and a shrewdness which give him place among the most renowned of Spanish *conquista-*

dores. Against him the Araucanian Indians began a war of resistance that was recurrently to be renewed in later times and not to be ended until the middle of the 19th century. The first phase of this most sustained Indian resistance was immortalized by Ercilla in the epic poem *La Araucana*, and the Indian hero Lautaro, enshrined in story and legend, remained for Chile and South America the personification of his race. After Valdivia was killed, 1553, Diego Hurtado de Mendoza was appointed governor, and in 1557 after an effective campaign, brought about a temporary submission of the aborigines. Inter-marriage of Spanish and Indians and mixture of blood were the bases of Chilean nationality; and, given the high quality of both ethnic factors, the product was a virile people, kept alert by the conditions of an active military frontier.

The structure and customs of society, the administrative organization and practice, the influence and activity of the Church, the restrictive and monopolistic features of the trade system were not notably different from Spanish imperial control in other colonies. Some peculiarities developed, however, to differentiate the colony. Its isolation and the menace of Indian wars, its dominantly agrarian life, its homogeneous Spanish population, of Extremadurians and Basques, made for a feudal society with strong social discipline.

Struggle for Independence. Although discontent with Spanish rule in Chile was not active, many complaints awaited opportunity for expression. There were several reasons why loyalty was weakened. Opinion was divided as to the need for commercial liberty. Many Chileans resented the expulsion of the Jesuits, who had been held in respect. Spain was reproached for keeping the colony in ignorance. A few had European experience and were zealous propagandists of French and English liberal thought, which endorsed political reform, democracy and intellectual freedom. The examples of the United States and France in their revolutions suggested new aspirations. There was much criticism of administration, the courts, and the unequal favor shown European-born Spaniards over natives. Some of the lower classes saw in revolution the chance of breaking down the barriers of a rigidly stratified society. All these were subversive causes; but events in Spain during 1808-10, and the example of Argentina set fire to the powder train and produced the revolutionary explosion. The patriot or independence movement was popular; but the loyalist element was large. Among the leaders were Martínez de Rozas, lawyer and exponent of European thought; Bernardo O'Higgins, natural son of Ambrose O'Higgins, a former governor and Viceroy; José Miguel Infante, spokesman of the municipality of Santiago; Camilo Henríquez, liberal priest and editor, and José MIGUEL DE CARRERA, able and impetuous soldier and dictator, the subject of more than a century of controversy.

The Chilean struggle for independence has four distinct periods: The first, 1811-14, after many vicissitudes ended at Rancagua in disaster for the patriot

cause. This period was marked by the beginning of the Carrera-O'Higgins feud, so difficult for a foreigner to understand, which has to this day divided Chilean opinion into bitterly hostile camps. The second period, 1814-17, was that of the Spanish reconquest, and it, with no little cruelty in operation, was a reaction to the practices and institutions of the colonial regime. The third, 1817-18, was the liberation of Chile by San Martín, as leader of a joint expedition of Argentine and Chilean forces. San Martín had decided in favor of O'Higgins against Carrera, when both leaders, having fled from Rancagua, submitted their controversy to him. After painstaking preparations, San Martín had crossed the Andes, one of the major feats of the South American wars for independence, and in a brilliant campaign had freed Chile. On Feb. 12, 1818, the political independence of Chile was proclaimed, an independence recognized by the United States in 1822. Under the leadership of O'Higgins as political director and of San Martín first and later of SIMÓN BOLÍVAR as successive military commanders, Chile participated in the final act of the drama of independence, the liberation of Peru.

The National Period. O'Higgins's service was significant both in his contribution to the conduct of war and to social and institutional reform. The opening of the National Institute and the founding of several schools, the war on banditry, the suppression of titles of nobility, the abolition of entails and of the sale of office were personal achievements. Under, as well as in spite of, the Constitution of 1818, he organized the political institutions. He was deposed by a revolution in 1823.

Chile in Anarchy, 1822-1830. Disorder, barrack mutinies, military dictatorships, paper constitutions, attempts at democratization through a Federal form of Government, and Conservative reaction made this a time of confusion. It was brought to a conclusion in the Battle of Lircay, Apr. 17, 1830, when the Conservative faction triumphed. Perhaps the most important outcome was the emergence of Diego Portales, formerly a merchant, as the reorganizer of the republic. Disgusted with anarchy, he as minister came to exercise powers of civil dictator in the interest of order. Destroying the prestige of the old army, exiling enemies, securing a new and conservative constitution, 1833, with a suffrage limited to men 25 years of age and ability to read and write, he inaugurated what Galdames calls the *República Autocrática*. Stability came to Chile, which entered upon a period of steady material and intellectual progress. Portales did not live to see the full fruits of his labor, since he was assassinated in 1837. Prior to this event, he had as his last great contribution asserted Chile's opposition to the proposed confederation of Bolivia and Peru and had declared war. At first unsuccessful, the Chilean army, led by Gen. Bulnes, in the Battle of Yungay, 1839, defeated Santa Cruz. Victory greatly increased the prestige and national pride of Chile.

The Autocratic Republic. The autocratic republic included the presidencies of Prieto, 1831-41,

Bulnes, 1841-51, and Manuel Montt, 1851-61. The opposition resorted to bloody electoral contests and revolution. Improvement in liberal leadership and the fusion of moderates brought in the *república liberal*, 1861-91, with Pérez, 1861-71; Errázuriz, 1871-76; Pinto, 1876-81; Santo María, 1881-86, and Balmaceda, 1886-91, as presidents. Two events of international importance occurred in this interval. Chilean participation in the conflict between Spain and Peru, 1864, and the War of the Pacific, 1879-84. Chile protested against the seizure of the Chincha Islands and the threat to Peru's independence, finally declaring war against Spain. One of the events of this war was the bombardment of Valparaíso, an unfortified port, Mar. 31, 1866. On this episode is based the claim that Chile is the only American state that has suffered loss of blood in defense of the MONROE DOCTRINE. The War of the Pacific was a fight in one sense over valuable nitrate and guano deposits, and in another over a series of treaties. The war involved Chile as one belligerent and Peru and Bolivia as the others. It evoked a fiercely patriotic reaction in each party; so there are three cases set forth in numerous official and private explanations of motives and acts. In the war, Chile showed superiority as a fighting power on both land and sea. By the separate peace engagements Chile received the whole of Bolivia's sea coast territory, and in outright cession the Peruvian province of Tarapacá. In addition, the provinces of Tacna and Arica were to be subject to Chile's control for 10 years and their permanent disposition thereafter to be determined by a plebiscite. This last point has been the subject of a prolonged controversy of 45 years duration with Peru and Chile making charges and countercharges of bad faith, with severances of diplomatic relations, and with many rumors of renewed war. The several attempts at settlement failed until the two countries under the auspices of the United States agreed to arbitrate their differences. The award of President Coolidge provided for a plebiscite, a solution which was abandoned amidst angry recriminations in 1926. Finally, after many suggested solutions had failed of acceptance, the two powers agreed in 1929 to divide the territory, with Arica going to Chile and Tacna to Peru.

The Liberal and Democratic Republics. The Liberal republic adopted many laws relaxing the rigor of the aristocratic system, making education more accessible to the masses, and secularizing many services previously controlled by the Church. In the administration of Balmaceda, radicals urged parliamentary reform. Chile had had executive domination to which Congressional domination had succeeded. A deadlock developed in the relations of the President and Congress, over the constitutional question of executive or legislative control. A civil war, accompanied by vexatious diplomatic conflicts with the United States over the *Itata* and *Baltimore* affairs, was the result. The enemies of the President won, and the parliamentary system with cabinet responsibility became an accepted feature of the *república democrática*, 1891-1924.

The political history of Chile from 1891-1925 was characterized by an arid parliamentarianism, the ministries being short in tenure and without a sustained legislative policy. Although Balmaceda was immediately discredited, his ideas and political testament eventually were remembered and endorsed. The advent of radical socialist doctrine, the increasing self-consciousness of the laboring classes, the charges of administrative and judicial corruption, the problems of monetary and banking reform in the World War and post-war years, the multiplicity of political parties, each and sometimes severally as problems, lent weight to the demand for constitutional changes. A matter that has received much attention, also, is that of foreign interests and the extent of their control of the nation's industrial and commercial activity. In 1920 Chile had a contested presidential election, settled without bloodshed. In the decade following it had a peaceful revolution by which a president was deposed and a short-lived military *junta* installed, 1924; it had its deposed president recalled and reinstated; it had a new constitution, 1925, which without altering the principle of centralization adopted the presidential instead of the parliamentary system; it tried a veiled dictatorship, 1927, and found it wanting. Chile succeeded in returning to a stable, constitutional regime; but in June 1932 the Government was overthrown in a revolution led by Socialists and supported by civil and military elements. W. W. P.

BIBLIOGRAPHY—Chilean History: D. Barros Arana, *Historia general de Chile*, 1884-1902; A. Edwards, *Bosquejo histórico de los partidos políticos chilenos*, 1903; G. F. S. Elliott, *Chile*, 1907; L. E. Elliott, *Chile To-day and To-morrow*, 1922; L. Galdames, *Estudio de la historia de Chile*, 1925; A. U. Hancock, *A History of Chile*, 1893; M. R. Wright, *The Republic of Chile*, 1904. The War of the Pacific. Barros Arana, *Historia de la guerra del Pacífico*, 1879; Barros Borgoño, *Tacna and Arica; the Solution of the Question through its Transfer to Bolivia*; A. Blantol Holley, *Historia de la paz entre Chile y el Perú*, 1919; Gonzalo Bulnes, *La Guerra del Pacífico*, 3 vols., 1912-19; Santa María, *La cuestión peruano-chilena, The Tacna-Arica Arbitration; The Case of Chile*, 4 vols.

CHILEAN LITERATURE, the literature of the Republic of Chile, South America, treated under the title, **LATIN-AMERICAN LITERATURE**.

CHILI, the pod of several species of peppers (capsicums). Both green and ripe chilies are pickled separately or added to other vegetables. They have a very "hot" flavor. The Mexican dish "chili con carne" is made of meat and beans and flavored with chili. The term "chili sauce" is used for a highly spiced dish made of tomatoes, onions and green and red peppers, finely chopped and cooked in vinegar.

CHILIAN MILL, a machine used in ORE TREATMENT, in which one or more wheel-like rollers travel in a pan around a central axis, crushing the ore by their weight.

CHILKAT, a Tlingit-speaking tribe, belonging to the North Pacific Coast culture area, living at the head of Lynn Canal in Alaska. The Chilkat are best known for their manufacture of unique blankets woven of mountain-goat wool mixed with cedarbark fiber.

CHILLÁN, a city of central Chile, situated about 55 mi. directly northeast from Concepción. It is a trade center for a grain- and cattle-raising district. About 44 mi. southeast the Volcan Viejo rises to a height of 7,000 ft. Hot sulphur springs gush from the sides of this volcano, and earthquakes are frequent. The city was founded in 1594, and the old town, now a suburb of the present city, was practically destroyed by an earthquake in 1835. Pop. 1930, 39,511.

CHILL HARDENING or chilling is the sudden cooling of semi-molten or molten metal, thus hardening its surface. Railway and trolley car wheels are sometimes cast in a mold having the rim part of cast iron, so that the molten rim coming in contact with it is rapidly cooled, giving it a hard surface.

CHILLICOTHE, a city in northern Missouri, the county seat of Livingston Co., situated on the Grand River, 87 mi. northeast of Kansas City. Bus lines and three railroads serve the city, which is a shipping point for grain, livestock and fruit, also for coal and asphalt. The chief manufactures include shoes, gloves, wood products and furniture. Chillicothe was founded in 1839 by John Graves. There are several mineral springs in the vicinity. Pop. 1920, 6,772; 1930, 8,177.

CHILLICOTHE, a city of south central Ohio and county seat of Ross Co., on the Scioto River and Paint Creek, 45 mi. directly south of Columbus. The Baltimore and Ohio and the Norfolk and Western railroads serve the city, and a commercial airport is 7 mi. northwest. Chillicothe is situated in a fertile farming region having available resources of coal, natural gas, sand, and gravel. Paper manufacturing leads the city's industries which had a total output of about \$12,000,000 in 1929. In the same year the retail trade was worth about \$11,510,000. Eight mi. south, Scioto Trail (State) Forest comprises 7,500 acres; and Seip Mound Park is a tract of archaeological interest. In the northern vicinity, Camp Sherman, maintained as a mobilization center, contains Mound City State Park, U.S. Veterans' Hospital 97, and an industrial reformatory. Chillicothe has been a trading center from its early days. Founded in 1796 by Virginians, it became in 1800 the capital of the Northwest Territory. It was incorporated in 1802. From 1803 to 1810, and again 1812-16, it was the seat of government of the new state of Ohio. Pop. 1920, 15,831; 1930, 18,340.

CHILLIWACK, a town of British Columbia, Canada, situated on the Fraser River, at the terminus of the British Columbia Electric Railway, 64 mi. east of Vancouver. Chilliwack is on the Canadian National Railway, and the Canadian Pacific is reached by ferry across the river to Agassiz. It is in a rich dairying, live stock, poultry and fruit-growing region and has creameries, cheese and woodworking factories, and a cannery. Lumbering also is carried on. Pop. 1921, 1,767; 1931, 2,431.

CHILTERNs, THE, a range of chalk hills in England, found through parts of Oxfordshire, Buck-

inghamshire and Hertfordshire. The Chilterns rise on the Thames near Goring, and extend in a north-western direction, sloping to the southeast and terminating between Dunstable and Hitchin. They form a part of a larger chalk system from Berkshire. These hills rise to an elevation of about 800 ft. near Wendover. Passes through the hills are utilized by motor and rail roads leading to London.

CHILULA, a small and unimportant tribe of the California division of the Athapascan stock. They lived in the northwestern portion of the valley of Redwood Creek in northern California and Bald Hills. Their near neighbors were the YUOK whose villages were at the mouth of the Creek and the Athapascan Whilkut who lived on the same creek. The tribe is practically extinct, though a few individuals have become scattered among other California peoples.

CHIMAERA, in zoology, the name given to a small group (*Holocephali*) of sharklike marine fishes, found widely in both hemispheres. Because of their grotesque appearance they are popularly known as spookfishes, ratfishes, elephant fishes and sea cats. Although of slight economic value they are of scientific interest because of their relationship to other cartilaginous fishes and especially to ancient types found as fossils in the rocks of the Triassic period. The California chimaera (*Chimaera collieri*), called also elephant-fish and ratfish, is common in shallow waters from Monterey to Alaska; it attains a length of 2½ ft. and is brown in color marked with white spots. The European chimaera or sea cat (*C. monstrosa*), which inhabits deep waters in the north Atlantic, attains a length of 3 ft.

CHIMBORAZO, MOUNT, a mountain of Ecuador and of the Andes, about 90 mi. south by west of Quito, in 1° 21' S. lat and 79° W. long. It rises to the height of 20,498 ft. above sea level, but only about 11,000 ft. above the level of the Quito valley to the north. In 1745 La Condamine ascended as high as 16,730 ft. Whympier reached the summit in 1880, and found that glaciers are discharged by all the upper combs encircling the ice-caped crater. Dr. Hans Meyer, who ascended Chimborazo and explored the Ecuador glaciers in 1903, discovered that these were formerly more extensive, reaching 2,500 to 3,000 ft. below their limits at that time. The mountain is built up of trachytic volcanic rocks and is an extinct volcano. It is perpetually capped with snow and was long wrongly supposed to be the highest peak in both Americas.

CHIMERA or **CHIMAERA**, in Greek mythology, a monster with the head and fore part of a lion, the body of a goat and the hind quarters of a dragon. Sometimes it is represented as having three heads, one of each of these animals. The monster breathed fire and was said to prowl around Lycia. It was slain by BELLEROPHON on his horse Pegasus. The Chimaera is often pictured in art and has become the symbol of the fantastic.

CHIMERE, a sleeveless, black or scarlet ceremonial robe of an Anglican bishop which is worn over the

ROCHET. It is made of silk or satin and is open in the front.

CHIMMESYAN or **TSIMSHIAN**, a North American Indian linguistic stock occupying the banks of the Nass and Skeena rivers in British Columbia and the coast to the south to Milbank Sound. Three major groups comprise this linguistic family: the Tsimshian of the lower Skeena River, the Gitksan of the Upper Skeena and the Niska of the Nass River. Though differing in language, in physical type and culture, they are most closely related to the Haida of Queen Charlotte Islands and the Tlingit of southeastern Alaska. The tribal traditions, however, point to an inland origin. Like other tribes of the Northwest Coast of America, their chief dependence for food is on the sea and rivers. Salmon and eulachon are the most important catches. Land mammals are also hunted. They are excellent woodworkers, their houses, canoes and practically all their utensils being fashioned from cedar. Socially they were organized into four clans, with maternal descent, each of which was further subdivided. In recent times the Chimmesyan have acquired some of the culture traits of the tribes to the south.

CHIMNEY, an arrangement of flues so designed as to conduct smoke from an indoor fire to the outer air. Although the existence in Roman times of **HYPOCAUSTS** presupposes some method of taking the smoke from the hollow floors and walls to the outer air, little, if any, architectural treatment was given these outlets. The modern chimney is an invention of the Middle Ages in Europe, and can be traced back to the 12th century. Chimneys of that period, both in France and England, consist either of simple flues carried up slanting through an exterior wall to an opening in the side of the wall, as in the 13th century example in Abingdon Abbey, Berkshire; or else of flues carried vertically up, projecting above the roofs or gable by means of an upright structure, sometimes circular in plan, as at Le Puy en Velay, 12th century, or rectangular, as in Abingdon Abbey, 13th century. These early chimneys were usually protected from the rain by conical or pyramidal hoods supported on colonnettes, or little piers, between which the smoke escaped.

With the growing luxury of the 15th century, the number of fireplaces increased greatly, and it became the custom to place them one over the other, and group the individual flues into a single large chimney. During the Gothic period in France, and the Gothic and early Renaissance period in England, the effort was often made to express in the design the number of flues in each chimney, as for example, in the Chateau of Pierrefonds. In England this led to the custom of building a single chimney base up to above the roof level; and topping this with a separate circular or polygonal stack for each flue. Many varied and beautiful effects obtained by using different designs on the stacks of each chimney, designs produced by the skillful use of cut brick, are found in all the great Tudor houses. Meanwhile in France

and on the continent generally, the tendency was to reduce the importance of exterior chimneys, keeping each group of flues or stacks in a solid rectangular mass, and decorating this simply with moldings, tracery, or surface ornament, as in the chimneys of the Chateau of Blois, built during the reigns of Louis XII and Francis I. As Renaissance influence became stronger, pilasters, cornices and pediments were sometimes applied to chimneys. But with the complete dominance of the classic ideal under Louis XIV, owing to the flatter roofs then fashionable, chimneys became unimportant, and were finally hidden as far as possible. In North Italian late Gothic and early Renaissance palaces, although fireplaces abound, exterior chimneys are unimportant owing to the flat slope of the roofs. They are carried up only short distances above the roof. Though usually simple, they are often crowned with terra cotta chimney pots or hoods of naive charm.

Modern chimneys are designed with great care to produce the necessary draft, and in most towns and cities are controlled by legal requirements in order to prevent fire hazards. In general the use of a flue lining of terra cotta tile is almost universal. Flue sizes for power plants, steam boilers and the like have been scientifically determined both as to height and area. (See **HEATING**; **COMBUSTION**.) For domestic fireplaces, it has been found that under ordinary circumstances a flue area of from 1/10th to 1/12th of the area of the fireplace opening is satisfactory.

T. F. H.

CHIMNEY PIECE, the decorative frame around a fireplace opening, including also the mantel shelf, and the overmantel decoration where these exist. The fireplace was apparently an invention of the 12th century, and various examples of that date show many elements of the later, more developed type. Early medieval chimney pieces are often of the hood type, with the hood bracketed out from the wall and decorated at its lower edge with horizontal moldings. Both rectangular and semi-circular or semi-elliptical plans are found. Sometimes the wall is hollowed out between the colonnettes, pilasters, or moldings under the brackets in order to give greater depth. During the 13th and 14th centuries the tendency was towards diminishing the projection of the brackets, and increasing the depth of the recess, making it rectangular, or with straight slayed sides. By the 15th century, many chimney pieces closely approximated in general shape those of the present day. Meanwhile moldings became more and more rich, and figure sculpture was freely used. The 15th century triple fireplace of the great hall of the palace of the counts of Poitiers is typical.

With the coming of the Renaissance, the detail of chimney pieces became classic, but the shape was little changed. Entablatures replaced Gothic moldings, and classic pilasters or columns supported them; sometimes an architrave surrounded the opening, as in many early colonial types. Especially beautiful chimney pieces were produced in the early Renaissance of

CHINA
(Entire Republic)
Ar. 4,279,170 sq. m.
Pop. . . 489,500,000

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)
Pop.—Thousands
812 Canton . . . R 11
500 Changchow . . . K 18
607 Changshu . . . K 14
650 Chengtch'g . . . C 14
600 Chengtu . . . H 7
635 Chungking . . . H 9
400 Fushan . . . L 14
388 Foochow . . . J 19
427 Hangchow . . . H 19
290 Hankow . . . H 15
400 Hanyang . . . H 15
500 Lanchow . . . E 7
300 Nanchang . . . I 16
523 Nanking . . . G 18
811 Peking . . . D 16
1500 Shanghai . . . R 11
500 Sian . . . F 11
500 Sianzhan . . . I 14
260 Soochow . . . H 20
1380 Tientsin . . . I 17
400 Tsinan . . . E 17
350 Tsinkei . . . E 15
500 Victoria . . . L 15
(Hongkong)
678 Wenchow . . . I 20
550 Wuchang . . . H 15

MONGOLIA
Ar. 1,367,000 sq. m.
Pop. . . . 2,500,000

SINKIANG
Area 550,340 sq. m.
Pop. . . . 2,688,000

TIBET
Area 463,200 sq. m.
Pop. . . . 1,500,000

SIAM
Area 200,148 sq. m.
Pop. . . . 11,500,307

PRINCIPAL CITY
(Including Figures from Latest Population Estimates)
Pop.—Thousands
600 Bangkok . . . P 4

FRENCH INDO-CHINA
Area 284,810 sq. m.
Pop. . . . 20,351,000

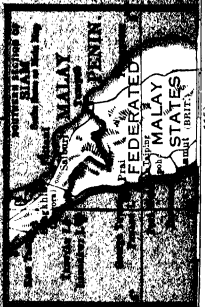
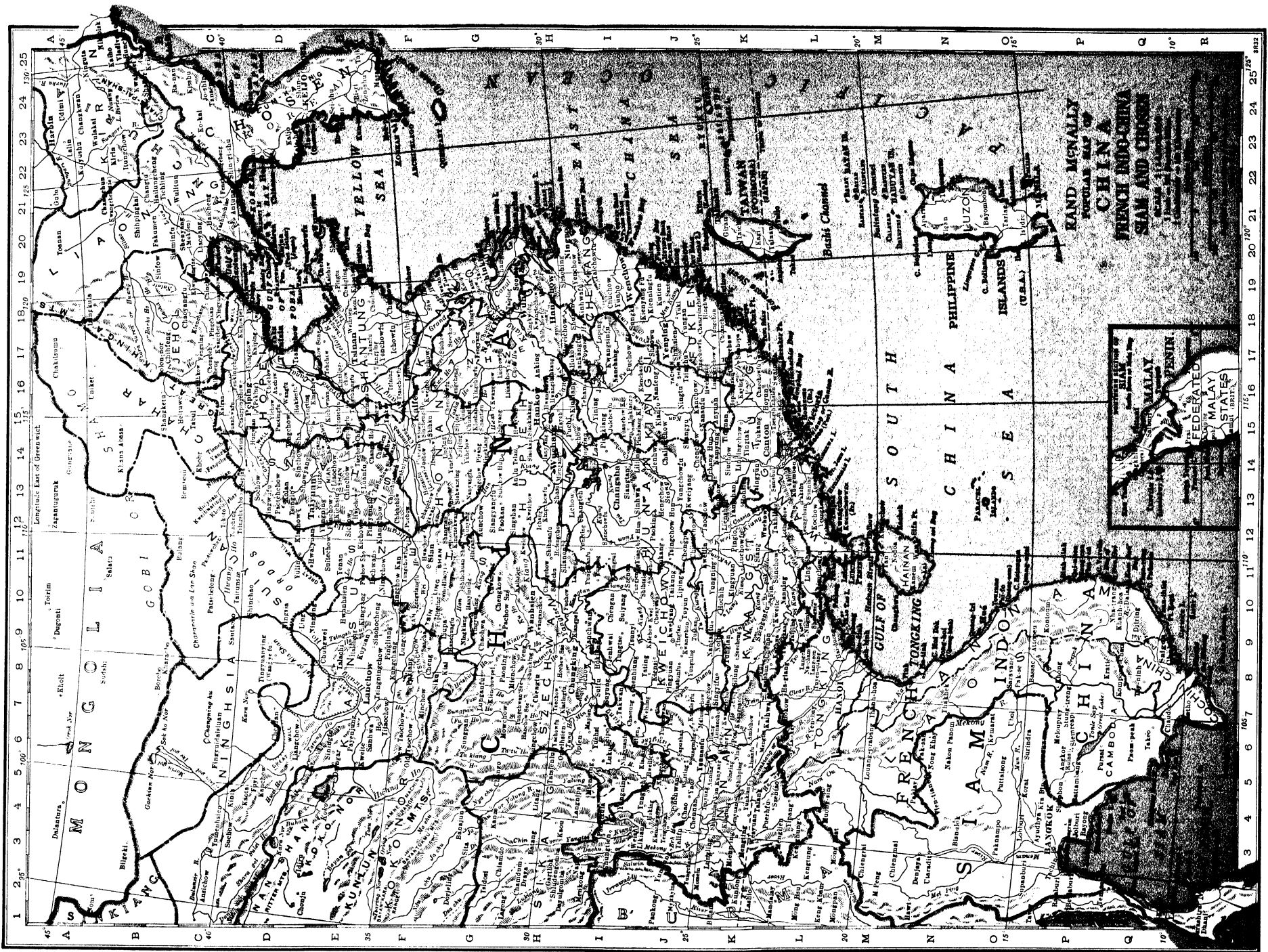
PRINCIPAL CITIES
(Including Figures from Latest Population Estimates)
Pop.—Thousands
134 Cholon . . . R 8
124 Hanoi . . . M 9
128 Hanoi . . . L 8

TAIWAN (FORMOSA)
Area 13,810 sq. m.
Pop. . . . 4,357,000

PRINCIPAL CITIES
(Including Figures from Latest Population Estimates)
Pop.—Thousands
74 Keelung . . . K 21
220 Tainan . . . J 21

CHOSUN (KOREA)
Area 85,206 sq. m.
Pop. . . . 21,057,989

PRINCIPAL CITIES
(Including Figures from Latest Population Estimates)
Pop.—Thousands
120 Hae-Jo . . . D 23
322 Kello . . . B 24



KAND MCNALLY
FRENCH INDO-CHINA
CHINA
SIAM AND CHOSUN

CHINA
(Entire Republic)
Ar. 4,279,170 sq. m.
Pop. 489,500,000

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)
Pop.—Thousands
812 Canton . . . K 11
500 Changchow . . . K 18
607 Chanchow . . . H 11
650 Chungking . . . C 17
600 Chengtu . . . H 7
645 Chungking . . . H 9
400 Fushan . . . L 14
388 Foochow . . . J 19
427 Hangchow . . . H 19
290 Hankow . . . H 15
400 Hanyang . . . H 15
500 Lanchow . . . E 7
300 Nanchang . . . L 16
523 Nanking . . . G 18
811 Peking . . . D 16
1500 Shanghai . . . H 20
500 Shao . . . J 11
500 Sian . . . H 14
200 Suichow . . . H 20
1380 Tientsin . . . H 17
400 Tsinan . . . E 17
350 Tsinan . . . E 19
500 Victoria . . . L 15
(Hongkong)
678 Wenchow . . . I 20
550 Wuchang . . . H 15

MONGOLIA
Ar. 1,367,600 sq. m.
Pop. 2,500,000

SINKIANG
Area 550,249 sq. m.
Pop. 2,488,000

TIBET
Area 463,200 sq. m.
Pop. 1,500,000

SIAM
Area 200,148 sq. m.
Pop. 11,500,207

PRINCIPAL CITY
(Including Figures from Latest Population Estimates)
Pop.—Thousands
600 Bangkok . . . P 4

FRENCH INDO-CHINA
Area 284,810 sq. m.
Pop. 20,451,000

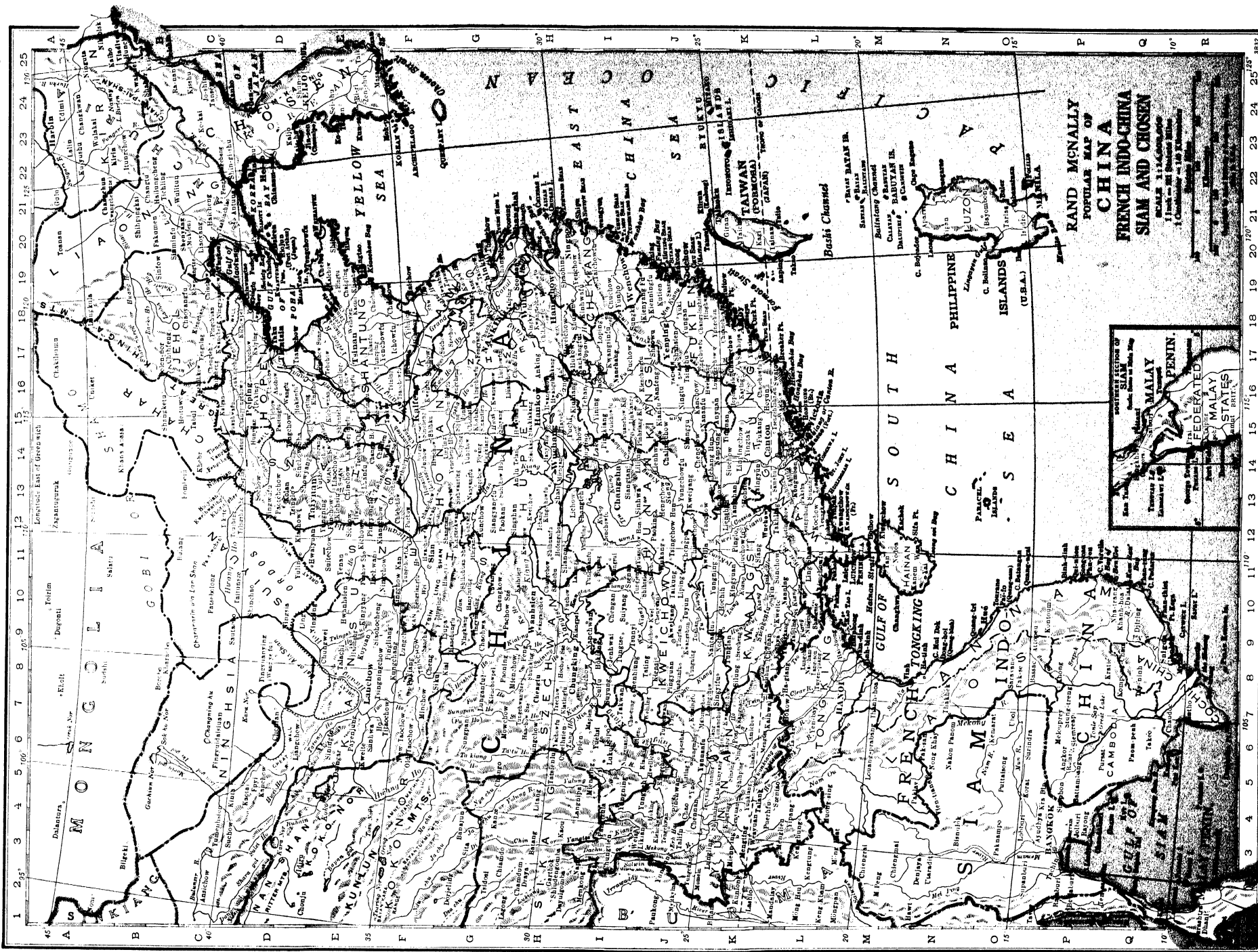
PRINCIPAL CITIES
(Including Figures from Latest Population Estimates)
Pop.—Thousands
134 Cholon . . . R 8
124 Haiphong . . . R 8
128 Hanoi . . . L 8

TAIWAN (FORMOSA)
Area 13,846 sq. m.
Pop. 4,345,000

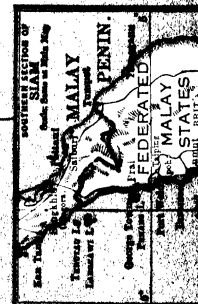
PRINCIPAL CITIES
(Including Figures from Latest Population Estimates)
Pop.—Thousands
74 Keelung . . . K 21
229 Tainan . . . J 21

CHOSEN (KOREA)
Area 85,206 sq. m.
Pop. 21,057,989

PRINCIPAL CITIES
(Including Figures from Latest Population Estimates)
Pop.—Thousands
120 Seoul . . . D 23
322 Keijo . . . B 24



RAND McNALLY
POPULAR MAP OF
CHINA
FRENCH INDO-CHINA
SIAM AND CHOSEN



North Italy, with delicate carving, and in the Renaissance styles of France generally, where the trend was from large examples with heavy over-mantels under Francis I to continually smaller and more dainty forms. In England early Elizabethan and Jacobean examples are large and often over lavish; those of the period of Jones and later of Wren in England and the American colonies were more classic, but



A CHIMNEY PIECE IN THE LOUIS XII WING OF THE CHATEAU AT BLOIS, FRANCE
Decorated with golden fleur-de-lis and the arms of France

still with some Baroque feeling. The later classical types of the Adam period are smaller and more refined.

CHIMPANZEE (*Pan troglodytes*), the ape most resembling man, found in fair numbers in equatorial Africa, from about 10° south to 12° north of the Equator and from the Atlantic coastline to the Nile. Among the apes the chimpanzee is closest to the gorilla, yet easily distinguishable from it by the outstanding ears, which are much larger even than man's. Nor is the chimpanzee so tall or massive as the gorilla, its skull is rounder and higher, the arched bony ridges above the eyes are not so enormous, the canines are smaller, and the facial expression is gentler and wiser.

The chimpanzee exceeds the orang-utan in stature, measuring normally 4 ft. in height. Its arms reach to the knees; its hands and feet are dark flesh-colored; its coat is brownish-black; its face is bald and yellowish, and around the face the hair streams downward like a beard.

Anatomically the chimpanzee stands closer to man than to the tailed monkeys. It can stand erect, though it is truly arboreal and when on the ground walks practically on all fours, leaning on its knuckles with its fingers turned in over the palm. For grasping it uses both feet and hands. Chimpanzees live in small bands in forests, aloft in the trees by day and descend-



COURTESY N. Y. ZOOLOGICAL SOCIETY
CHIMPANZEE

ing to the ground mornings and afternoons for their food, which consists mostly of fruit, roots, tubers, and leaves and shoots of succulent plants. In captivity they have been known to catch and eat rats and pigeons. They construct rude, platform-like nests of twigs and foliage in the tree-tops, where they sleep and bring up their young.

Though chimpanzees are possessed of extraordinary strength and in the wild state may be foes only less formidable than the gorilla, more than a match for any man, they are gentle and affectionate in captivity while young. As they grow older the males especially turn dangerously savage. Because of their superior intelligence, which operates more like a human being's than a monkey's, they can be taught things that man alone may be supposed able to learn. But they sicken soon in captivity, usually with a pulmonary ailment, and rarely live long.

CHINA, the largest country in Asia, with an authentic history dating back to 2205 B.C., occupying

an area of approximately 4,280,000 sq. mi., or about one-third larger than continental United States. The territory extends from latitude 53° N. to 18° N. and from longitude 74° E. to 134° E., thus reaching 4 degrees further north and 7 degrees further south and stretching 3 degrees further from east to west than the United States, excluding Alaska. To the east and south lie the seas which are parts of the Pacific Ocean. The land frontiers, beginning with CHOSŌN (Korea) on the northeast, run north, west, southwest, south and southeast, passing Chosen, Siberia, Russian Turkestan, India, Burma and Tongking. The coast line is in the form of a semicircle approximately 2,150 mi. long, or, allowing for indentations, 5,000 mi. A number of small islands lie off the southeast coast; the only large island still belonging to China is that of Hainan, lying to the south. The island of FORMOSA formerly belonged to China, and the Chinese Empire exercised suzerainty over Korea and the countries to the south and west as far as Burma.

The area of China ordinarily is spoken of as divided into five principal regions: China Proper, MANCHURIA, MONGOLIA, SINKIANG and TIBET. The term "China Proper," as ordinarily used, refers to that part of China which lies south of the GREAT WALL and east of the Himalayan Mountains. Politically speaking, the term is no longer appropriately limited to this region but should include Manchuria, the southern part of Mongolia, or Inner Mongolia, and Sinkiang. Manchuria was formally changed from a dependency into an integral part of China by Imperial Decree in 1907, when the three Manchuria districts were given the status of provinces and the whole area was made a vicerealty. Sinkiang and the special administrative areas of Inner Mongolia were made into provinces by the Republican Government in 1928. In that same year, a new province was created in the southwest, consisting of land bordering in Tibet which formerly had been the special district of Chuanpien. This comes within what ordinarily is spoken of as China Proper. The general area of Mongolia ordinarily was spoken of as divided into Outer Mongolia, i.e., the northern part, and Inner Mongolia. Inner Mongolia was divided into five special administrative areas; Outer Mongolia was loosely held as a dependency. In 1924, under Soviet Russian influence, a Soviet Mongolian Republic was set up including the western end of Outer Mongolia. Nominally this still is under Chinese suzerainty; practically it is a part of the Soviet Union. The 28 provinces of China now are:

"CHINA PROPER": the old "eighteen provinces" of Anhwei, Chekiang, Fukien, Honan, Hopei (formerly Chihli), Hunan, Hupeh, Kansu, Kiangsi, Kiangsu, Kwangsi, Kwangtung, Kweichow, Shansi, Shantung, Shensi, Szechuan and Yunnan, and the new province of Hsukang.

MANCHURIA: the three provinces of Heilungkiang, Kirin and Lianong (formerly Fengtien).

INNER MONGOLIA: the five new provinces of Chahar, Chinghai, Jehol, Ninghsia and Suiyuan.

TIBET: the region to the southwest of China.

SINKIANG: the new province created from the former dependency of the same name.

MONGOLIA: the area formerly frequently referred to as Outer Mongolia.

Area and Population. No accurate survey of the area of China, or of its several parts, has been made. The boundaries between the different regions, particularly of the more thinly settled Mongolia, Sinkiang and Tibet, also are somewhat vague. Approximate areas are as follows: The 19 provinces of China Proper, 1,530,000 sq. mi.; the 3 provinces of Manchuria, 380,000 sq. mi.; the 5 provinces of Inner Mongolia, 550,000 sq. mi.; the province of Sinkiang, 550,000 sq. mi.; the dependency of Mongolia, 810,000 sq. mi.; the dependency of Tibet, 460,000 sq. mi.

Accurate population data also are lacking, no careful census having been taken. Estimates vary considerably, particularly for Mongolia, Sinkiang and Tibet. Approximate figures for 1930 (based, for China Proper on estimates by the Chinese Post Office) are as follows: China Proper, 437,500,000; Manchuria, 30,000,000; Inner Mongolia, 3,500,000; Sinkiang, 2,500,000; Mongolia, 1,500,000; Tibet, 6,500,000. Total, for the 28 provinces, 473,500,000; total for all China, 480,500,000. There has been a steady increase in the population of China in recent decades. The populations of Manchuria and Inner Mongolia have grown very rapidly during the past twenty years. Government estimates of the population of China in 1381 A.D. put the figure at 59,850,000; in 1762 at 198,214,000; in 1885 at 377,636,000. In 1930 there were in China approximately 912,000 foreigners, of whom 550,000 are Chosenese, 256,000 are Japanese, 65,400 are Russians, 13,000 are British, 8,600 are French and 6,900 are Americans. The area of Szechuan Province alone is greater than that of any European country except Russia. Sixteen Chinese provinces have a larger population than New York State, the most populous state in the United States. Szechuan has a population considerably larger than that of the United Kingdom.

Physical Features. Manchuria is in the form of a huge horseshoe, with the opening to the south. The sides of the shoe are made by heavily forested mountain ranges; in the center is the great plains region, through which run two principal rivers, the Liao, draining southward, and the Sungari, draining to the north and east. Westward from Manchuria, the mountains slope downward somewhat to the vast plateau which is Mongolia. A large portion of Mongolia is desert; the rest is chiefly grassland. Southward from the eastern part of Mongolia, lie a series of small ranges which lead down to the great alluvial plain of the lower Yellow River (HUANG HO) basin in China Proper. To the southwest of Mongolia lie mountain ranges which rise one after the other until the Himalayas are reached. Inner Mongolia, Sinkiang and the western provinces of China Proper are broken up by mountains, separated by valleys. Tibet, lying in the Himalaya area, is extremely mountainous, with one large central table-land section and a few other small regions of the same sort.

China Proper, eastward from the western mountains, is divided into three principal regions. To the north is the Yellow River basin, in the center is the YANGTZE KIANG RIVER basin and in the south is a hilly country which is drained by rivers running southward, the most important being the West River. An east-west range of hills divides the Yellow and Yangtze river basins. After the Yellow and Yangtze rivers leave the mountains, they enter vast alluvial plains which stretch from 700 to 1,000 mi. to the coast. These plains form perhaps a third of the total area of China proper, but contain over half of the population.

Climate. Because its coast line is comparatively short in proportion to its total area, China in general has a continental rather than a seaboard climate. Northern Manchuria and Mongolia have sub-arctic temperatures. Manchuria has fairly abundant rainfall; Mongolia in the main is semi-arid. Sinkiang and the northwestern provinces of China Proper lack rains but have numerous small streams fed from the mountain snows. Szechuan and Tibet are well supplied with rain and rivers. Rains in the lower Yellow River basin are seasonal, the rainy season being in the summer, and in most years are adequate for agriculture, although periodically protracted droughts occur which result in serious famine conditions. This region is cold in winter and hot in summer. The Yangtze valley gets abundant rainfall and seldom knows heavy frosts. South China stretches down into the tropics, with corresponding temperature conditions and ample rains. Rainfall at Peiping is approximately 25 in. a year, at Shanghai 44 in. and at Canton 69 in.

Animals and Plants. The animal life of China is of very wide variety, including northern and mountain forms in the north and west, and tropical forms in the south, with an overlapping in the central Yangtze valley. The principal domestic animals are pigs, horses, donkeys, camels (particularly in the north), cattle, chickens, ducks and geese. Fur-bearing animals abound in the north in a number of important varieties, including the sable and the marmot. Edible fish of various kinds are plentiful in the bordering seas and in the lakes and rivers. The plants of China range from the tropic to the subarctic. Rice is grown chiefly in the south and the Yangtze valley. Wheat, millet, kaoliang or sorghum and maize are the principal northern cereals. Tobacco and cotton are grown widely in the central and northern parts of China Proper. Persimmons, grapes, apples, pears and oranges are among the fruits. Tea is produced in the central and southern regions, which also are the regions of the mulberry tree on the leaves of which the silk worms feed.

Minerals. Formerly it was thought that China had virtually inexhaustible supplies of coal, and large amounts of iron. More careful investigations in recent years have shown that this is not the case. China's resources of these essentials of modern industry, in fact, are comparatively small in terms of her area or population. Coal is mined in every province, but the total reserves, according to the Geological Sur-

vey, are between 40 and 50 billion tons. The northeast, including Manchuria, and the central Yangtze valley are the principal coal areas. Production in recent years has been growing steadily, and was approximately 25,000,000 tons in 1930. Iron ores are found in most of the provinces, and the deposits for the country total roughly 700,000,000 tons of ore containing about 300,000,000 tons of iron. The most important iron ore regions are Manchuria and eastern Mongolia, and the central Yangtze valley. Iron production is estimated at around 1,000,000 tons annually, although a large part of this is smelted in small and primitive plants. Little is known about China's oil resources. Large quantities of oil shale are found in Manchuria and in northwestern China Proper, although the shale is of poor quality. Oil deposits have been located in Shensi and Szechuan provinces. China is comparatively rich in tin, particularly in the southwest, copper, lead, zinc, antimony and tungsten. Gold is found in Manchuria, Mongolia and Szechuan in considerable quantities. Silver is fairly widely distributed.

Agriculture. China is primarily an agricultural country; from 80% to 85% of the people get their living directly from the soil. In the more congested regions, particularly the alluvial plains of China Proper, and in the mountain valleys elsewhere, the soil is worked in comparatively small plots which are cultivated intensively and kept fertile by heavy fertilization. Wherever water is available, hillside frequently are terraced well toward the top. In the more arid regions in the north, irrigation, from streams or wells, is used to a considerable extent. The Chinese, having been farmers for well over 40 centuries, have learned the value of crop rotation, careful fertilization and other devices for maintaining the productivity of the soil. In general, the people live in villages, going out to their fields in the morning and returning at night. The land holdings are small, as a rule, there being very few large landed estates. A large proportion of the farms are from seven to ten acres. In some of the more fertile regions, families of five or six get their entire living from as little as two or three acres. Most of the farms are owned by those who work them; in certain parts of the Yangtze valley tenant farmers form as high as 30% of the total but this is quite exceptional. Most farming families have at least one domestic animal to help in the plowing, etc., but by far the greater part of the farm work is done by hand. Modern machinery, sometimes owned on a co-operative basis, is finding its way into the newly-developed farming regions of Manchuria where the farm holdings are comparatively large.

Food crops, such as cereals, beans, peas, vegetables and fruits, form the great bulk of the agricultural products in China. In the central and northern parts of China Proper, cotton is widely grown, chiefly for making up into clothing in the farming homes but, increasingly in recent years, also for export. Silk is an important farm product in central and southern China; the Chinese have been producing silk for over 4,000 years. Tea is grown in the south and southeast,

chiefly on land which, on account of its slope or for other reasons, cannot be used for food crops. Formerly tea and silk were China's two principal exports; lately their relative importance has decreased. Pigs and chickens are raised on almost every farm, partly for home consumption and partly for sale. The exports of pig bristles and of dried egg products have reached large proportions in recent years.

In general, China has been producing enough food to feed her own people, with a small surplus for export. The rapid development of agriculture in Manchuria has resulted in substantial food exports from that region, principally to Japan and China Proper. Droughts and floods in recent years have cut down the food production and caused heavy importations of food, chiefly of rice.

Industry. For centuries China has had a highly-developed system of handicraft manufacturing, with the skilled workmen organized into special guilds for each form of handicraft. A large proportion of the farming homes contained spinning and weaving equipment with which the clothing for the family was made from raw cotton grown on the farm or purchased.

Modern factory manufacturing started with the opening of a cotton cloth factory at Shanghai in 1888 by the Chinese. The Treaty of Shimonoseki (1895) which ended the Sino-Japanese War provided that Japanese might engage in manufacturing in China. Under the "most favored nation" treaty clauses, this opened the way to other foreigners. The development of cotton spinning and weaving mills in China was rapid, the Chinese, Japanese and British taking the lead. In 1930 there were 81 Chinese and 46 foreign-owned cotton mills in China, with 2,326,872 and 1,642,680 spindles respectively. Cotton manufacturing has remained the most important of the modern industries, but both Chinese and foreigners have branched out into other fields, particularly other textiles, iron and steel, matches, chemicals, foodstuffs, cement and other building materials, toilet goods, etc. There are few lines of manufacturing which are not carried on in China in modern-style factories.

The development of modern industry has been especially rapid in recent years. This has advanced so far already that not only are the imports of manufactured goods, particularly of textiles, being proportionately reduced but exports of manufactured goods have grown from a negligible amount in 1920 to about \$35,000,000 in 1930. This development of manufacturing has been encouraged by anti-foreign boycotts and by the adoption of a protective tariff policy.

The British have been particularly active in the development of coal mining, with their interests chiefly in the Tientsin area and central Honan. The Japanese have developed both coal and iron mining, and iron production, working chiefly in Manchuria but with large interests in Shantung and the central Yangtze valley. There has been considerable Chinese development of modern mining.

Transportation and Communication. In the old days, transportation in China was carried on by

carts and wheelbarrows in the plains, and by carrier coolies, donkeys and horses in the hills. Junks provided transportation along the coast, and boats of various sizes plied the rivers, streams and numerous canals. Most of the goods which were produced were consumed within a comparatively narrow radius, however, so that the total amount of transportation required was relatively small. This situation still exists to a large extent, although the coming of railways and motor cars and of steamships has brought important changes. The demand for transportation of both people and goods has increased faster than the supply, however, so that despite the development of these modern means, there are to-day more carts, wheelbarrows, coolies, donkeys and junks in use in China than there were before the first railway was built.

Railway construction in China started in 1876 with a small line from Shanghai to Woosung, built by foreigners. Popular opposition compelled the Chinese authorities to buy the line and tear it up. In 1880 the Chinese started construction near Tientsin. Foreigners became actively interested in railway construction beginning in 1895. From that time until the overthrow of the Manchu dynasty in 1911 most of the railway building was done under foreign domination, the lines being built as part of the Chinese Government railway system but with money in part loaned by the foreigners who kept a measure of control over operations. Since 1912, and particularly in the last few years, the Chinese themselves have been active in railway building. In 1912 there were approximately 5,900 mi. of railways in China; at the end of 1930 there were 10,850 mi., an increase of 84%. In 1912 the entirely Chinese lines were 1,350 mi., or 23% of the total; in 1930 they were 3,670 mi. or 34% of the total. In 1930 there were 3,910 mi. of railways in Manchuria, 5,010 mi. in North China, 1,180 mi. in the Yangtze valley and 750 mi. in South China. The "concession" lines in 1930, controlled or dominated by foreigners and operated separately from the Government railway system, were: the Chinese Eastern Railway (Russian; 1,415 mi. including branches) and the South Manchuria Railway (Japanese; 690 mi.) in Manchuria; the Yunnan Railway (French; 290 mi.) connecting Yunnan and French Indo-China; and the Kowloon Railway (British; 29 mi.) connecting Hong-kong with Canton.

The rivers and canals, on which shallow-draft boats are used in transportation in China, total approximately 62,000 mi. A substantial part of China's internal transportation is carried on boats. In the past couple of decades, Chinese and foreign-owned steamships have taken an increasingly important part in river transportation, especially on the Yangtze, as well as in the coast trade. The total shipping passing through the Chinese Maritime Customs has increased from 80,109,000 tons in 1907 to 155,606,000 tons in 1930. Of this 1930 total, the British had 37%, the Japanese 29%, the Chinese 19% and the Americans 4%.

The use of motor buses for freight and passenger transport has grown rapidly in recent years, and has brought a corresponding increase in the mileage of motor roads. These latter, especially in the plains, frequently are made of dirt. The length of motor roads was about 500 mi. in 1921, and over 3,500 mi. in 1930. In 1930 there were approximately 35,000 motor cars registered.

Telegraph lines have been extended widely throughout China, and wireless plants have been erected in a number of centers, for national and international communications. There are over 53,000 mi. of telegraph lines. Telephones, local and long distance, are growing rapidly in use. Airplanes have come to play an important part in military communications. A regular air service is maintained between Shanghai and Hankow and is planned for other routes.

Defense. The original Chinese came down into the country from the northwest as military invaders, and from early times the problem of defence against invaders from the north has been a serious one. Chin Shih Huang Ti in 214 B.C. built connections between frontier defences, creating the Great Wall to help in keeping out invaders from Mongolia. Subsequent additions were made to this wall. Invasions continued, however. Two of China's more important dynasties, the Mongol or Yuan dynasty in the 13th and 14th centuries and the Manchu dynasty (*see* MANCHUS), which ruled from 1644 to 1912, were established by northern invaders.

Although the Chinese invented gunpowder and had primitive cannon and flintlocks, their very inferior fighting equipment led to their being easily defeated in clashes with Western forces in the 18th and 19th centuries. At the latter end of the 19th century, Yuan Shih-kai, then viceroy at Tientsin, began the organization of a "model army" which was equipped and trained along modern lines. The armies which have been built up since then have been formed and equipped in this way, although the training generally has been slack and the equipment poor. The long period of wars between military chieftains which followed the death of Yuan in 1916 resulted in the accumulation of a vast horde of men who were mercenary soldiers under the various war lords. Estimates of the number of these "armed coolies" put the total between 1,500,000 and 2,000,000 in 1931. A few crack divisions have been developed, particularly the "Whampoa Cadets" which formed the spearhead of the Nationalist armies in the advance northward in 1926-28. It has been demonstrated at various times that the Chinese, when adequately trained, make excellent soldiers. Experience in fighting in 1927-30, showed that given an adequate incentive, they were ready to fight desperately and to continue fighting in spite of extremely heavy casualties.

Arsenals for the production of modern weapons have been built at a number of the more important centers; each warlord tried to get such a source of supplies for himself. The largest arsenal in the Far

East was that built in Shenyang (Mukden) by Chang Tso-lin, with the aid of retired British and German officers. This arsenal was seized by the Japanese at the time of their occupation of Shenyang in September, 1931. Most of the arsenals are poorly equipped. Airplanes have been added to the equipment of the armies in the last few years, but so far they have not figured much in the actual fighting, although they have been used considerably in scouting.

The Chinese navy consists of a few small cruisers, useful chiefly for police purposes and against pirates. A start was made toward building up a navy at the end of the 19th century, but the ships then available were destroyed by the Japanese warships in the SINO-JAPANESE WAR of 1894-5.

The nationalist government has made many attempts to reorganize the army so as to eliminate the many independent commands, disband the less effective elements, reduce the total number under arms, improve the efficiency of those who were retained, and, in general, to create an effective fighting force for China. So far these efforts have been largely unsuccessful, chiefly because of the unwillingness of the local chieftains to surrender the power which command of troops, even inefficient troops, gives them.

Foreign Trade. China was carrying on foreign trade with the Mediterranean countries before the beginning of the Christian era. Modern foreign trade began with the arrival of Portuguese trading ships in 1516. British, American, Portuguese, Dutch, French and Spanish traders were doing business with China before the end of the 18th century. China's exports at that time consisted almost entirely of tea, silk, chinaware, furs and ginseng. Imports were largely cotton piece goods and opium. These articles remained the principal trade items until well toward the end of the 19th century. In 1870, cotton goods formed 31% of the total imports and opium 36%. In 1900 opium was only 15% and cotton goods were 36%. In 1930, opium imports had been prohibited (1917); textile imports of all kinds had decreased to 16% of the total, but imports of raw cotton and cotton yarn for cotton manufacturing in China had become 11% of the total. Machinery, metals and minerals, tobacco, kerosene, chemicals, none of which were imported in more than negligible amounts prior to 1900, each formed 4% or more of the 1930 total imports. In 1870 tea exports were 48% of the total and silk 39%. Beans and cereals were only 1.6%. In 1900 silk was 31%, though the amount exported was twice that in 1870; tea was 15.6%; beans and bean products were 4%. In 1930 beans and bean products were easily the most important export item, with 21% of the total; silk and silk products came next with 16%; tea was only 2.9%. Animal and vegetable products, excluding silk and wood, were 62.5%. The total imports in 1870 were Taels 70,000,000 or \$110,000,000; exports, Taels 62,000,000 or \$95,200,000; total trade, Taels 132,000,000 or \$205,200,000. The 1900 figures were: imports, Taels 210,000,000 or \$156,500,000; exports, Taels 160,000,000 or

\$119,300,000; total Taels 370,000,000 or \$275,800,000. In 1930 the amounts were: imports, Taels 1,310,000,000 or \$604,000,000; exports, Taels 895,000,000 or \$412,000,000; total, Taels 2,205,000,000 or \$1,016,000,000. The dollar value fluctuates widely with the fluctuation in silver (tael) exchange.

All through the 19th century and well into the 20th century, Britain held the lead in the foreign trade of China. Japan became an important factor after 1900. American trade with China, though comparatively small 30 years ago, now comes next to Japan's. In the past 20 years, 1911 to 1930 inclusive, Japan's trade has been 27% of the total, British (excluding Hongkong which is a transshipping rather than a trade center), 16% and American 15%. The proportions for 1926-30 inclusive were: Japanese, 28%; American, 16%; British, 15%. Trade through Hongkong was 21% of the total for 1911-30 and 16% for 1926-30.

Finances. The expenses of government in the old days were comparatively small. The principal tax was the land tax, the amount to be paid being determined by established custom. Following the TAIPING REBELLION, 1850-64, the Maritime Customs Administration was re-organized under partial foreign control. The customs revenues soon became the largest and most reliable source of central government revenue. Toward the end of the 19th century, the government was faced with heavy demands for money, to pay indemnities, meet loans, etc. At first the customs revenues were pledged to meet these obligations. Then it became necessary to tap other revenue sources and, in 1913, the Salt Gabelle Administration was reorganized with foreign participation. Domestic and foreign loans with no, or only nominal, security also were floated. The danger that foreign loans for political purposes might lead to serious consequences led to the formation, in 1920, of the international Consortium, the members of which agreed to give each other the opportunity to share in all loans to China. The Chinese objected to this move to limit China's freedom of action, and since 1920 no foreign loans have been floated, except for certain loans from the Japanese for railway construction in Manchuria. Many of the domestic and foreign loans have fallen into default. The nationalist Government, however, though it has borrowed heavily on the domestic market, has succeeded in meeting these loan obligations regularly. At the end of 1930 the outstanding domestic debt of China amounted to Chinese \$637,441,000 or roughly U.S. \$190,000,000 and the foreign obligations to approximately U.S. \$945,000,000. The customs revenue for 1930 was U.S. \$83,200,000.

Banking activities in earlier times were carried on by private organizations or guilds which functioned somewhat like the similar bodies in Europe in the 17th and 18th centuries. Modern foreign banks began operations in China early in the 19th century. Modern-style Chinese banks began to be formed around the beginning of the 20th century, and their development has been particularly rapid since the be-

ginning of the Republic. Modern Chinese banks now engage in every sort of banking activity, and they have become serious competitors of the foreign banks even in the financing of foreign trade. At the end of 1930 there were 161 modern-style Chinese banks, with an aggregate capital of Chinese \$287,187,000.

Government and Law. Government in China developed out of primitive clan groups living under semi-pastoral conditions and acknowledging the vague authority of a priest-king who was essentially the mediator between the people and the forces of nature, rather than the temporal ruler. This religious conception of part of the functions of the emperor continued as long as the imperial system lasted. The emperor, nominally the absolute ruler, continued to be also the chief priest, and each year he made his report to Heaven, ceremoniously taking on himself the blame for things which had been done amiss in the country. To a very real extent, the emperor's authority depended on his moral excellence and, in the minds of the people, rebellion and the overthrow of the ruling dynasty not only were justified but were required when the emperors became morally degenerate. The emperor, too, stood in the relation of father to his people; while his authority theoretically was absolute, he was supposed to exercise that authority for the benefit of the people rather than for his own aggrandizement or pleasure. When he permitted the government to become excessively oppressive he violated one of his fundamental moral obligations and so lost his right to rule. Hence, revolt against the constituted authorities, as a means of ending oppression and degeneracy in the government, was held to have a necessary place in governmental theory and practice, revolt not only against the Emperor but against the officials in the successive lower ranks, for these officials stood in much the same relation to the people under their jurisdiction as the Emperor stood to the people as a whole.

The ideal condition was considered one in which the people would be so well behaved and mutually considerate that governmental action would be unnecessary. In actual practice, the management of the affairs of the villages, the families, the guilds and similar bodies, which included practically all the people, was left as far as possible to the members of these groups. The officials collected the taxes, and did as little else as possible in the way of enforcing laws. Theoretically, the administration was extremely centralized; practically it was extremely loose.

In general, custom, supplemented by occasional, special imperial decrees, was the law of the land. The customs varied from one part of the country to another. Property rights were determined chiefly by village and guild custom. The field of commercial law was covered by the customs of the guilds. Penal law also was largely a matter of custom. Differences between individuals generally were settled by arbitration out of court; even when cases came before the magistrates, the decision was supposed to be

rendered on the basis of what would be fair or just in the circumstances rather than of fixed rules of law.

The officials, under the old system, were selected through examinations in the classics, promotion in the official ranks depending, theoretically and to a large extent practically, on the passing of successive examinations. A deliberate attempt was made to keep the officials from establishing close contacts with the people under them, contacts which might tend to make them less impartial, by provisions that no official might hold a post in his native province and that no post might be held for more than three years. These provisions also helped to keep the loyalty of the officials directed toward the emperor rather than toward the people.

The system was open to serious abuse, which became especially marked as degeneracy and corruption set in toward the ends of the successive dynasties. By the time that modern Westerners began to go to China in more than incidental numbers, i.e. in the early years of the 19th century, the Manchu dynasty had pretty well run its course and official corruption and abuse of power had become widespread. This, together with fundamental differences between Western and Chinese conceptions of law, led to considerable friction between Chinese and foreigners, and to the establishment of the system of extraterritoriality by which the foreigners were under the jurisdiction of their own officials. The revolt against the Manchu dynasty broke out in the very serious Taiping Rebellion in the middle of the 19th century. This rebellion was put down, but the anti-Manchu feeling continued to grow until, in 1911, it again broke out in the form of a revolt which led to the overthrow of the dynasty and the establishment of the Republic. Meanwhile, a start had been made in the effort to work out written codes of law based in general on Western practices.

The government set up in 1912 was modelled after that of the Third Republic in France. It was, in theory and form, entirely alien to Chinese ways; practically, it never succeeded in becoming a republican government in any Western sense. After a series of civil wars, between what in effect were feudal, militaristic chieftains, a new form of government was adopted in 1928. This was, in theory, a dictatorship by the Kuomintang or Nationalist Party, with the governmental machinery operated by a series of committees. The example of Soviet Russia was drawn on for the names and some of the forms of organization of the new government, but the system was in its essentials a return to ancient and widespread Chinese ways of doing things. The committee system was the rule in the old guilds as well as in the villages; the form of organization and method of operation of the Kuomintang follow very closely the form and method of the semi-political secret societies which have existed in China for many centuries. Being more in line with Chinese practices, the new governmental forms seem to hold more promise of success than did the republican forms adopted in 1912.

The present government is organized on the "five power" principle enunciated by SUN YAT-SEN. At the top is a State Council, whose chairman is the titular head of the state. Under this are five *yuan* or departments: the executive, the legislative, the judicial, the examination and the control. The several executive ministries, finance, foreign affairs, army, navy, interior, etc., are in the executive *yuan*. The legislative *yuan* has approximately the functions of legislative bodies in western countries. The judicial *yuan* has charge of the judicial system. The examination *yuan* is intended to work out and operate a civil service system. The control *yuan* has the function of watching the activities of all the officials to see that they perform their duties properly. This *yuan* is a partial revival of the "board of censors" which was an integral part of the old imperial government; the examination *yuan* follows in part the old board in charge of examinations for official posts. The "constitution" is the "organic Law" which was promulgated on the authority of the Kuomintang on October 4, 1928. In promulgating this organic law, the Kuomintang assumed a dictatorship over the country, but it also announced that this dictatorship would last only for a "period of tutelage" during which the people would be trained in self-government. There is considerable overlapping of membership between the committees of the Kuomintang and the departments of the government so that the actual control of the party and the governmental machinery is in the hands of a comparatively small group. The subordinate administrative units are the provinces and the *hsien* or counties. A few of the larger cities have been made into special municipalities with the status of provinces.

Since the establishment of the Republic, increasing attention has been given to the revision and codification of the laws and to the reorganization of the judicial system, in an attempt to bring them more into line with Western ideas and practices so as to hasten the day when extraterritoriality can be abolished. The Nationalist Government has been particularly active in this direction, and has prepared and promulgated a series of codes covering the majority of the fields of law. It also has established a number of courts organized on modern lines, with modern-trained judges. In the main, European rather than American precedents have been followed. As yet, however, these changes have had little effect throughout the vast interior of the country, where ancient custom still is strong and magistrates decide to a large extent as they may think fit.

Religion. TAOISM is the chief strictly indigenous religion in China. It is based, in theory, on the teachings of Lao-tse, who lived in the 6th century B.C. Taoism to-day is a corrupt and degenerate conglomeration of animism, witchcraft and demonology, with little left of the founder's teachings. BUDDHISM, the other principal religion in China, came into the country from India, in the form of the Mahayana teachings, during the first century of the Christian

era. The Buddhists in China are divided into many sects, and the religion in practice bears little resemblance to the teachings of Buddha. MOHAMMEDANISM came into the country in the 7th century and has spread in large part through the immigration of peoples of Mohammedan racial stock. The Mohammedans are located almost entirely in the far north-western provinces. Christianity, in the form of NESTORIANISM, entered China in the 7th century. For a time the Nestorian missionaries secured a large following, but by the end of the 16th century the church seems to have completely disappeared. Catholic missionaries visited China early in the 14th century, and Catholic missionary work has continued down to the present, though for a time in the 16th and 17th centuries Christianity was officially banned. Protestant missionary work began in 1807.

The Chinese are not temperamentally a deeply religious people, though the peasants, like peasants everywhere, have many superstitions. There is nothing in China corresponding to the castes in India. The Mohammedans keep themselves, religiously, sharply distinct, but the line between Buddhism and Taoism is very vague for most of the people. It is impossible, therefore, to get even approximate figures of the number of Buddhists and Taoists. The Mohammedans number between 15 and 20 million. In 1930, the Catholic Chinese communicants numbered approximately 2,000,000, and the Protestant approximately 650,000.

Confucianism is not, strictly speaking, a religion, though it has its temples and priests. It is a system of ethics and philosophy which has to do specifically with the relations of men in this life. It has been the general foundation of Chinese society of many centuries.

In recent years there has been, in China, a marked revolt against religion of all kinds, especially among the younger educated groups. This has been met by attempts by Confucian, Buddhist, Taoist and Christian leaders to reform and re-state their doctrines in terms which will appeal to modern Chinese.

Education. Education in the old days consisted of learning the Confucian classics. It was carried on by private tutors or in small village or temple schools. The government as such did not concern itself with education. The purpose of getting an education was primarily to pass the examinations for admission to official life. In 1898 a National University organized on western lines was established by the government at Peking. In 1905, by imperial decree admission to official life was made possible by examination in modern studies as well as in the classics. This opened the way for active development of modern education in China, a development which has gone forward particularly since the establishment of the Republic. Under governmental auspices, national and provincial, a system of primary and secondary education has been worked out, based in the main on the American system, and universities and higher technical schools have been established in the im-

portant centers. Private Chinese initiative also has led to the establishment of numerous educational institutions from primary schools through universities. In 1930 there were 29 national and provincial universities and 14 private universities recognized by the Ministry of Education. The school enrollment in 1930 was approximately as follows: primary schools of all kinds, 10,000,000; secondary schools, 175,000; colleges and universities, 35,000. Besides the regular schools there are numerous organizations concerned with education such as the Academia Sinica, the National Education Association and the Association for the Advancement of Mass Education. An important part of modern Christian missionary work in China has been the development of schools, from kindergartens through universities. The American Protestant missionaries have been especially active in this field. G. C.

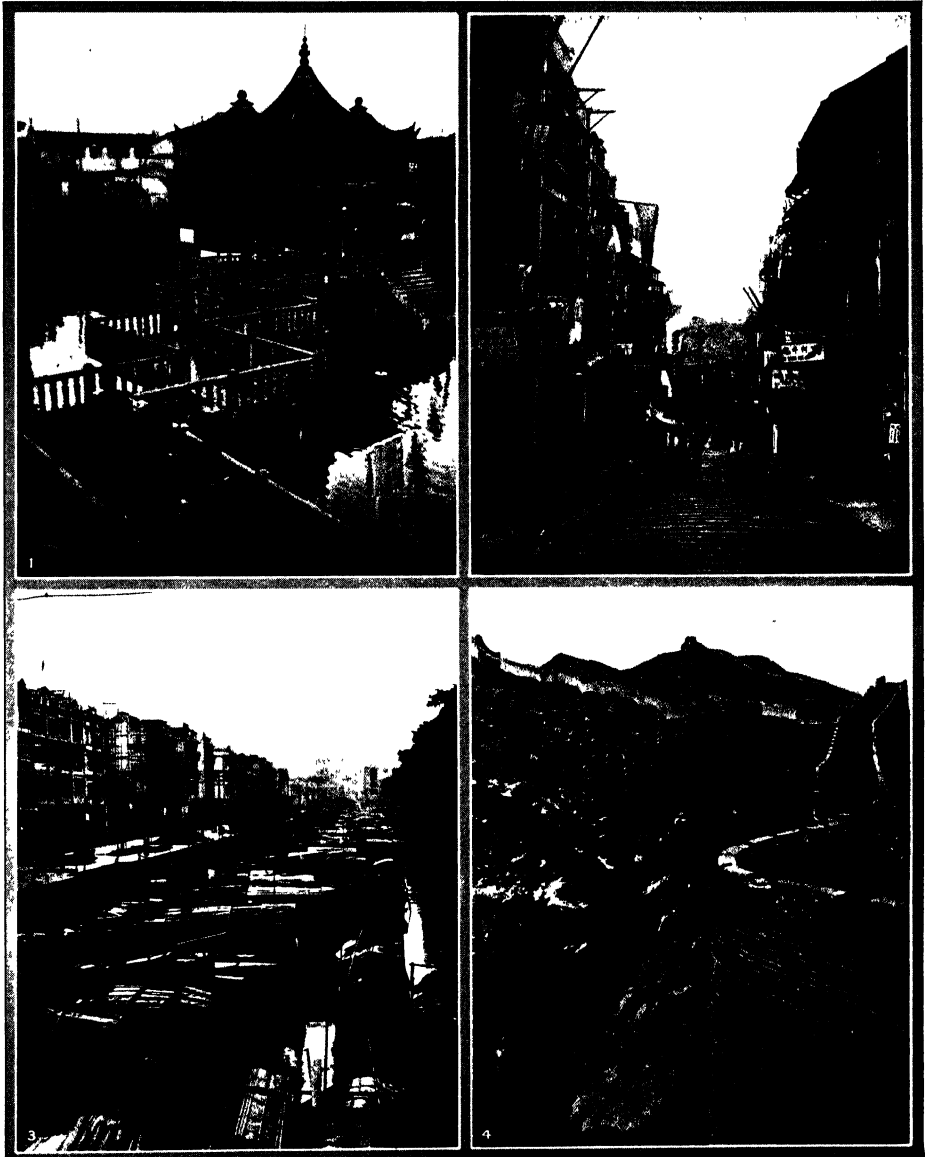
CHINA, HISTORY OF. Geological conditions of the cave at Chou Kou Tien, 30 miles south of Peiping, where many head bones of *Sinanthropus pekinensis* were recently found, indicate that man existed in China at least 300,000 years ago. From this time to the Palaeolithic Age of approximately 25,000 years ago is an enormous gap which has not yet been bridged by any authentic information. Although no skeletal remains of Palaeolithic man have been found, tools and weapons show that men were present in northern China.

The next traces of human life belong to an advanced Neolithic culture which appeared about 5,000 years ago, with human types such as exist today in northern China. Stone axes and knives, bone arrowheads and needles, earthenware utensils and musical instruments indicate that the culture of this age was connected with the main Eurasian cultural area. The absence of metal on most of these sites has led Andersson to class this period as Aeneolithic, or transitional between the Neolithic and Bronze periods. Even at this time the people were agriculturists, living in villages, raising various grains, and possessing the most common domesticated animals.

Cultural Origins. The Chinese have mythical, legendary accounts which attempt to trace their history to its beginnings. These accounts tell of P'an Ku, the "Creator"; of Sui Jen, the "Fire Producer"; of Fu Hsi, who introduced matrimony; of Shen Nung, to whom is ascribed the introduction of agriculture; of Huang Ti, who is said to have been the first builder of houses and cities; and of the ideal rulers, Yao, Shun, and Yu.

The earliest written records locate the ancestors of the Chinese in the upper reaches of the Yellow River valley, but it is probable that invading tribes, not racially Chinese at all, came from Central Asia in successive waves of migration. Once in the northern part of China, these tribes established city-states and intermarried with the aborigines. The theories of some Western scholars that Chinese culture had its origin in the borders of Burma and Tongking, or in the Tigris and Euphrates valley, are no longer tenable.

CHINA



1. 3. 4. COURTESY CANADIAN PACIFIC STEAMSHIP LINES 2. RED STAR LINE

ANCIENT AND MODERN CHINA

1. Willow Pattern Tea House in the Chinese quarter of Shanghai. The Chinese believe an evil spirit cannot turn a corner, hence the approach to the tea house. 2. Sharply

sloping street leading from the harbor, Hong Kong. 3. Canal at Canton. 4. Part of the Great Wall of China, the longest line of defence ever built by man

CHINA



RURAL SCENES IN CHINA

1. Natives in the garden of a tea house. A lotus pond is in the foreground.
2. Laborers with oxen irrigating a paddy or rice field.
3. Fishing with cormorants. A strap is tied around the bird's neck to keep it from swallowing the fish.
4. Cultivating land near Hong Kong.

THE FEUDAL PERIOD

The Hsia (c. 2205-1766 B.C.) and the Shang Dynasties (c. 1766-1122 B.C.). Out of the early city-states and the intermarriage of their rulers, there developed new kingdoms and dynasties. The first two recorded dynasties are called the Hsia and the Shang dynasties. The collapse of the traditional chronology makes it necessary for the student of Chinese history to take the opening and closing dates of these two dynasties with considerable reservation. The tradition of an ancient unified empire under "model emperors" also is untenable, but archaeological remains indicate that the people enjoyed a comparatively high degree of culture. China unfortunately has lost almost all the written records of these ages of cultural creation.

The Chou Dynasty (1122-255 B.C.). The Hsia, Shang, and Chou dynasties are linked together by the Chinese under the title of the "Three Dynasties" (*San Tai*).

Comparatively little is known of the first two of these dynasties; historians are much better informed regarding the Chou kingdom, which was located on the western frontier. It was during the Chou period that a universal search after truth arose. This issued in three principal schools of thought. The first is the school of Lao Tzu, the "Ancient Philosopher" (born c. 590 B.C.), who is credited with the writing of the *Tao Te Ching*. The great word of this book is "Tao" which is best translated as "way"—the mysterious, spontaneous "Way of Nature." The school of Lao Tzu advocated a return to the primitive state of nature, and, therefore, opposed all plans for the regulation of human life by the sages. The second school is that of CONFUCIUS (551-479 B.C.) for whom the Tao is not a mysterious activity of nature, but a real, ethical way of life. Confucius had a profound belief in the power of right thinking and of correct social forms to mold character and control life. The third school, that of Mo Ti (c. 500-420 B.C.), was at the other pole from the school of Lao Tzu and also was quite critical of Confucianism. Mo Ti was a consistent utilitarian who advocated the doctrines of universal love, of the futility of war, of mutual benefit, and pragmatism. Whereas the teachings of Lao Tzu and of Confucius exerted a profound influence upon subsequent Chinese culture, those of Mo Ti were consigned to obscurity and were unearthed only in modern times.

THE PERIOD OF RECONSTRUCTION

The Ch'in Dynasty (255-206 B.C.). The welding of the feudal states into a unified empire was chiefly the work of Ch'in Shih Huang Ti, the "First Emperor of Ch'in." He divided the country into provinces whose officials were directly responsible to him, extended the boundaries of the empire, inaugurated a uniform system of weights and measures, and standardized the form of the written language.

To defend his borders from the barbarian tribes on the north, he linked up earlier isolated fortifications, thus building the CHINESE WALL. He believed that

the time for idle philosophical speculation had passed and that the country needed a dictator backed by a powerful army. To put an end to the disputations and criticisms of the scholars and to break the hold of tradition, his prime minister, Li Ssu, induced him to issue a decree which resulted in the "Burning of the Books," in 213 B.C. This decree exempted from destruction only books on medicine, divination, and horticulture. Ch'in Shih Huang Ti died in 210 B.C. and the house of Ch'in collapsed four years later.

The Han Dynasty (206 B.C.-220 A.D.). Liu Pang, of the house of Han in the region of the modern province of Shensi, named his dynasty the Han, and took the title of the "August Emperor" (*Kao Ti*). He boasted that he had conquered the empire on horseback, but he soon found that he could not govern it on horseback. He called upon the Confucian scholars, who alone understood the best traditions of the past, to propose laws and rules of court etiquette. They planned the civil service examinations and helped to perpetuate the archaic classical language. Confucianism was made the state religion of China. Literature and art revived, but philosophy did not reach the heights of the Chou period. Although Taoism was espoused by many in high position, it soon degenerated into magic.

The continuity of the Han dynasty was temporarily interrupted by a usurper, Wang Mang, who ruled as the "New Emperor" (*Hsin Ti*), 9-25 A.D. In order to give his family a kingly origin and furnish a documentary basis for its social and political reforms, it is believed that Wang Mang employed scholars to forge the "ancient script texts" of the Confucian classics. Although his memory was desecrated by later Confucian scholars, he inaugurated many strikingly modern social reforms, including the nationalization of land, the equal distribution of land, and the abolition of slavery.

At the height of its power, the Han dynasty extended its influence west as far as Bactria, south of the Yangtze as far as Tongking, and northwest into Korea. It was during the Han period that BUDDHISM entered China and contacts were established with the Hellenistic world. To this day the Chinese call themselves the "Sons of Han."

THE PERIOD OF POLITICAL DISUNION

The Three Kingdoms (220-280), the Chin Dynasty (265-420), and the Division between North and South (420-589). This period is the dark age of Chinese history. It was a time when there was much bloodshed and when priceless relics of art and literature were destroyed. Three kingdoms now gained prominence. These were the Wei in the north, the Wu in the lower part of the Yangtze valley, and the Shu in Szechuan. Liu Pei, the scion of the House of Han, his loyal general Kuan Yu, worshipped later as the God of War, and the strategist Chu-ko Liang, together with the treacherous Ts'ao Ts'ao, are heroes of Chinese romance. Another feature of this time was the constant struggle between the Chinese in the south

and the less civilized tribes of the north. In 355 A.D., Buddhism was officially recognized. In 527, Boddharma, the sixty-second Indian patriarch, arrived in China, and founded the powerful Ch'an, School of Meditation. Many Chinese, notably Fa Hsien, went on pilgrimages to the Buddhist centers of India.

THE PERIOD OF CULTURAL PROSPERITY

The Sui (589-618), the T'ang (618-907), and the Five Dynasties (907-960). After the long period of disunion, the Sui dynasty begins a brilliant era in Chinese history. In art, in literature, and in education this period is justly famous. The painting of Wu Tao-tzu, the poetry of Li T'ai-po and Tu Fu, the prose style of Han Yu are regarded as models to-day. In the year 785, the famous Han Lin academy was founded. The achievements of the T'ang era dazzled the impressionable Japanese, who adopted many features of Chinese civilization. Christianity, in the form of Nestorianism (*see* NESTORIANS), MOHAMMEDANISM, ZOROASTRIANISM, and MANICHAISM found their way into China during this period. So permanent has been the influence of the T'ang dynasty, that the Chinese still call themselves the "Men of T'ang" (*T'ang jen*). Although the so-called Five Dynasties ushered in a period of decadence, it was during this time that wooden blocks began to be used in place of stone slabs in printing.

THE PERIOD OF CONFLICT BETWEEN CULTURE AND BARBARISM

The Sung Dynasty (960-1280). Chao K'uang-yin, the founder of the Sung dynasty, had to contend with the kingdom of Hsia in the modern province of Kansu, with the Khitans of the Liaotung peninsula, and with the "Golden" (*Kin*) or the Nu-chen Tatars. Despite these barbarian invasions the Sung empire experienced a great cultural revival. The invention of printing with movable type promoted the study of the classics. The time was ripe for a systematic reinterpretation of the Confucian records in the light of new hypotheses which were derived from the cosmological ideas of Taoism and the subjective philosophy of Buddhism. This task was accomplished by the so-called Sung school of philosophers, whose most prominent representative was Chu Hsi (1130-1200). This school also founded the famous academies (*shu yuan*) for personal conference and free pursuit of knowledge. Wishing to strengthen the empire and drive out the foreign invaders, Wang An-shih (1021-86) tried to reorganize agriculture, trade, and industry. His plans for reform included the introduction of agricultural credits, the abolition of the corvee, and the establishment of a general property tax. These reforms were doomed to failure because of the obstruction of the most prominent statesmen of the empire, chief of whom was Ssu-ma Kuang, the great historian.

The Mongol or Yuan (original) Dynasty (1280-1368). Lacking the culture of the Chinese, the Mongols, who invaded China from the northwest, added little to Chinese civilization. The suspension

of the civil service examinations from 1237 to 1313 caused the authority of the classical language to decline and many great writers wrote novels and dramas in a style closely akin to the spoken language. KUBLAI KHAN made his capital at Peking and from there ruled the vast Mongol Empire of which China, territorially, was considerably less than half. Kublai used many Europeans in his administration, and during his reign China was brought to the attention of the West through the descriptions of travellers. Most notable among the merchant travellers were the Venetians, Nicolo and Maffeo Polo, and the son of Nicolo, MARCO POLO who arrived in China in 1271. The Chinese inventions of paper, printing, the compass, and gunpowder found their way into Europe. Christianity, which disappeared from China Proper in the 9th or 10th century, reappeared in the Mongol period, brought both by Nestorians and by Roman Catholics. When the Mongol Empire collapsed after the death of Kublai, and the Mongols were finally driven out of China, Christian communities again passed out of existence and a period of foreign exclusion followed.

The Ming Dynasty (1368-1644). During the Ming era China was ruled by a purely Chinese dynasty. The founder, Chu Yuan-chang, better known by his royal title, Hung Wu, established his capital at Nanking. In order to cope with the invaders on the northern frontier, the capital was transferred to Peking, in the reign of Yung Lo (1403-25). It was in the year 1407 that the *Great Encyclopedic Library of Yung Lo* (*Yung Lo Ta Tien*) was published, consisting originally of ten thousand volumes, most of which were destroyed by fire in 1900. Despite this stupendous literary achievement, and the manufacture of inimitable porcelain, the Ming dynasty was not a period of great cultural prosperity. Although the philosopher, Wang Yang-ming (1472-1529), challenged the orthodox Confucianism of Chu Hsi, for which he is remembered in Japan as well as in China, his criticisms did not go deep enough to create an intellectual revolution. Modern Western traders began coming to China in 1516, and considerable friction had developed between them and the Chinese before the end of the dynasty. In 1552, St. FRANCIS XAVIER died on the island of Shang Ch'uan, or St. John, in a vain attempt to enter China, but in 1601 Matteo Ricci, the Jesuit missionary, succeeded in establishing the Society of Jesus in Peking. A rebellion, led by Li Tzu-ch'eng, caused a loyal general, Wu San-kuei, to invite the Manchus to help suppress it. The rebellion was put down, but the Manchus remained as rulers.

THE MODERN PERIOD

The Manchu or Ch'ing Dynasty (1644-1912). The Manchus, entering China from Manchuria, did not establish their rule without opposition. This opposition was strongest in the Yangtze valley and in the south where the so-called "left-over scholars" (*I-lao*) of the Ming dynasty refused to take any positions either in the government or in the civil service examinations. Thwarted in their efforts to re-

establish the Ming dynasty and disillusioned with the so-called Sung learning, they set to work to reexamine the most ancient documents of the Han dynasty for a solution of China's political and cultural problems. They not only prepared great dictionaries, encyclopedias, and reprints of the classics, but they developed an indigenous science of historical and literary criticism which had nothing to learn from the West. They learned something of the physical sciences from the Jesuits, but the latter were discredited by the famous "rites controversy" as to the toleration of certain Chinese rites among the Christian Chinese, and also by the conflict with the enlightened emperor, K'ang Hsi (1662-1723), on the question of the correct term for God.

The greatest hindrances to a mutual understanding on the part of China and the West were the aggressions of the Western powers and the arrogance of the Manchu court. The traffic in opium, which foreign merchants, chiefly British, smuggled into Canton with the connivance of corrupt Chinese officials, and the unwillingness of the Manchu court to treat with the British envoys on an equal basis led directly to the first war with Great Britain and the first group of foreign treaties, 1839-44. The Treaty of Nanking, signed in 1842, provided that five ports be open to foreign trade; that Hongkong be ceded to England; and that China pay an indemnity of \$21,000,000 (Chinese currency). Subsequent treaties with England and with other Western nationals contained tariff, trade and extra-territorial provisions.

The seizure by Chinese officers of a Chinese-owned ship flying the British flag, and the murder of Père Auguste Chapdelaine, a French priest, led to the second foreign war and the second group of treaties, 1856-60. By the treaty of Tientsin, signed in 1858, China was forced to open more ports to foreign commerce; allow foreigners to trade along the Yangtze River; give special protection to Christian missionaries; cede Kowloon, opposite Hongkong, to England; pay an indemnity; and provide for the admission of foreign diplomatic missions to Peking. This last provision recognized the equality of foreign nations with China and resulted in the founding of the Board of Foreign Affairs (*Tsungli Yamen*) in 1861.

In addition to these problems arising out of the foreign impact, the imperial government was confronted by formidable internal rebellions, the most destructive being the TAIPING REBELLION, 1850-64, which cost approximately 20,000,000 lives and laid waste the southern half of China. Although this rebellion failed, it was followed by a series of lesser revolts and by continued anti-Manchu agitation which culminated in the overthrow of the dynasty and the establishment of the Republic in 1912.

W. F. H.

Modernization Begins. Westerners, who had been pushing in increasing numbers into the Far East since the beginning of the sixteenth century, continued to expand their activities in China during the nineteenth. Russia, developing her dream of an

Eastern empire, had occupied Siberia north of the Amur River by 1860, incidentally taking part of Manchuria. In 1896 she secured from China a concession to build a railway across North Manchuria and down to the Liaotung Peninsula. Two years later she took a lease on the end of the peninsula, and proceeded to transform Port Arthur into the heavily fortified ice-free naval base which she long had wanted. Great Britain took China's tributary Burma in 1885 and leased Weihaiwei in 1898 as an offset to Russia's lease on the Liaotung Peninsula. France substituted her own for China's suzerainty over Annam, Tongking, and Cambodia and leased Kwang-chowwan in the southwest in 1899. Germany in 1898 took, on lease, the port of Tsingtao and the Kiaochow area. Meanwhile, Japan had been at war with China, 1894-95, as a result of differences over Korea and, in the Shimonoseki Treaty of 1895, had secured the island of Formosa and the Liaotung Peninsula—the latter of which she was forced to give up by Russia, Germany and France. During the 1895-98 period, when the defeat of China by Japan had seemed to be a prelude to the collapse of the great empire, the Western powers had entered into the "battle of the concessions" to establish "spheres of influence," secure railway and mining rights and otherwise prepare to make effective claims for substantial shares of China when China should be dismembered. The mutual jealousy and distrust of the powers over the division of the prospective spoils, made them turn a willing ear to the "Open Door" proposals which JOHN HAY, then secretary of state of the United States, put forward in 1899.

The BOXER UPRISING of 1900 came partly as a protest against this foreign aggression and partly as a conservative reaction against the growing demand that China be modernized. Prior to the Taiping Rebellion there had been little inclination to do anything toward modernization. The Taiping leaders, during the earlier years of the rebellion, however, announced as part of their policy the reconstruction of the country along modern Western lines. The tide began to turn toward new ways. In 1872 a group of students was sent to the United States to study, though they later were recalled. In the same year a Chinese steamship company was organized. In 1876 foreigners were given permission to build a small railway from Shanghai to Woosung—which soon was bought and torn up by the Chinese authorities—and in 1880 railway construction by Chinese started in the north in spite of imperial prohibition. In 1888 a modern cloth factory was started by Chinese. In these and numerous other moves toward modernization, LI HUNG-CHANG played a leading part. Then began the literary criticism of the old ways, which included attacks on the authenticity of many of the ancient scripts and insistence that Western science should be studied because of its practical benefits. In 1895 SUN YAT-SEN had his first clash with the authorities in his campaign for the overthrow of the Manchus. In 1898 the young Emperor Kuang Hsu, with the co-operation of a group

of young enthusiasts who had had some education in Japan, attempted to reform the whole administrative and social system in a series of edicts which followed one another in rapid succession—only to be ousted by the conservative Empress Dowager Tzu Hsi. The rapid rise of Japan as a result of her efforts to modernize herself, and particularly her defeat of China in the war of 1894-95, were powerful stimuli to the demand for modernization in China—a demand which expressed itself in part in the adoption of Western arms and military organization.

The Boxer Uprising occurred only in the northern provinces near Peking; the rest of the country was either indifferent or, especially in the more progressive Yangtze valley, definitely opposed to the efforts to oust the foreigners. Western armed forces quickly put down the uprising, a huge indemnity was exacted and other humiliations were inflicted. The Empress Dowager herself saw the need for modernization, and the reform movement gained rapid headway. Plans were made for transforming the empire into a constitutional monarchy along Western lines, but the Manchu dynasty had been completely discredited, and the agitation for its overthrow, led by Sun Yat-sen, came into the open with a revolt at Wuchang on Oct. 10, 1911. On Jan. 1, 1912, Sun Yat-sen became provisional president of the Republican Government which was set up at Nanking. On Feb. 12, 1912, the Manchu Emperor formally abdicated.

The Chinese Republic (1912-). Yuan Shih-kai, a Chinese, was in virtual control at Peking, on behalf of the Manchus, at the beginning of 1912. He arranged the Manchu abdication on condition that he be made the first president of the Republic. Sun Yat-sen resigned in his favor and he was elected on February 15. On March 10 the National Council at Nanking adopted a provisional constitution. Yuan formally assumed the presidency on the same day, in Peking.

Yuan, however, was not in sympathy with the Republican ideal. He soon came into conflict with the Parliament. In 1915 he moved to make himself emperor, but this stirred up a serious revolt and he dropped the plan. In June, 1916, he died, and the vice-president, Li Hyuan-hung, became president. Li, however, was not a strong man, and Yuan's death was quickly followed by the first of a series of wars between the principal figures in the politico-military machine which Yuan had built up. One after another of these leaders secured control, only to be ousted by a combination of rivals. Parliaments sat and were dissolved. Constitutions were revised and scrapped. When Yuan's immediate associates had eliminated one another, the "civil wars" continued between men who had risen to prominence in the preceding campaigns. The authority of the Peking Government steadily dwindled. Finally, in July, 1927, CHANG TSO-LIN, an ex-bandit who had risen to power in Manchuria, frankly scrapped the Republican machinery and declared himself dictator.

Meanwhile Sun Yat-sen, bitterly disappointed with

the way things were going under Yuan and his successors, made various attempts to establish what he called the only legitimate Republican government. His headquarters were at Canton, but even from this city he was compelled to flee on two occasions. Sun tried desperately but unsuccessfully to get foreign recognition for his government. In 1923 he even went so far as to request the United States to arrange for the establishment of an international administration over China which would teach the people how to govern themselves. Failing to secure help from this and other foreign powers to whom he appealed, he turned, in 1924, to Soviet Russia. An understanding was reached by which the Russians, in return for the opportunity to spread anti-capitalist and anti-imperialist propaganda in China, gave Sun and his associates in the KUOMINTANG (Nationalist Party) technical aid in organizing and carrying through a military drive northward, and a certain amount of money and arms. Before the drive actually started, however, Sun made a trip to Peking in response to invitations from the then military rulers there to come and help work out a plan for the unification of China. He was given an enthusiastic welcome but no real hearing. He died in Peking on Mar. 12, 1925.

During the following summer, the plans for the northward drive from Canton were pushed and the drive started in 1926. By the spring of 1927 the Yangtze valley had been occupied by the Nationalist forces. Then a split occurred between the Russian-dominated radicals and the moderates in the Nationalist ranks. Each side, particularly after Sun's death, had simply been using the other for its own advantage, pending what seemed to be an appropriate time to take complete control. The radicals forced the issue by engineering the "Nanking incident" of Mar. 24, 1927, in which the foreigners in the city were attacked. The purpose was to discredit the leader of the moderates, CHIANG KAI-SHEK, and to stir the foreign powers to the use of strong measures, which in turn would create a wave of anti-foreign feeling in China on the crest of which the radicals could ride into power. The incident, instead, turned popular feeling strongly against the radicals, and Chiang and the moderates promptly seized the opportunity to break with the Russians and suppress the radicals. An unsuccessful attempt was made to push north to Peking in the summer of 1927. The next year, the co-operation having been secured of the two principal military leaders in the north who also were at enmity with Chang Tso-lin, the drive was successful, in spite of a temporary setback as a result of a clash with Japanese troops who had been sent to protect Japanese lives and property in Shantung. The Nationalist armies entered Peking on June 8, 1928. On Oct. 10, 1928, the anniversary of the outbreak of the revolution which overthrew the Manchus, the National Government of China was inaugurated at Nanking. This government was set up on the authority of the Kuomintang; it made no pretense of being anything but the creature of a dictatorship of that party. Just before the end

of the year, the Manchurian authorities declared their allegiance to the National Government, and for the first time since the death of Yuan Shih-kai the country was at least nominally unified politically.

Dissatisfaction of various military leaders with what they considered undue interference in the local affairs of their districts or improper neglect of their right to a share in the administration led to further civil wars, in 1929 and 1930. These were successfully suppressed. Uprisings of landless men who had formed what they called "Communist armies" caused considerable trouble for the Nanking Government in the spring and early summer of 1931. Dissatisfaction with what they felt were the unduly arbitrary methods of Chiang Kai-shek as head of the Government, led a group of the Kuomintang leaders to withdraw from Nanking and set up a separate government at Canton in the summer of 1931. Then came the Japanese military move into Manchuria. Feeling against Chiang grew, in part on the ground that he did not attempt to fight the Japanese. The Canton group insisted that he must resign, to get national unity in the face of this new threat from Japan. Finally he did so, on Dec. 16, 1931, and a reorganization of the personnel of the government followed.

In spite of the continuing politico-military disorganization in the country, China's position in relation to the foreign powers steadily improved, on the whole, between the establishment of the Republic and the summer of 1931. Japan strengthened her position in Manchuria through the "twenty-one demands" of 1915, but China has regained control of what were the German holdings before the World War and of the Russian holdings except the Chinese Eastern Railway. All of the British concession and leasehold areas have been returned to China except at Tientsin and Kowloon. China secured full tariff autonomy in 1929, and considerable progress has been made toward the abolition of extraterritoriality. The Western powers have quite definitely given up the idea of any new aggression in China and are holding on to their remaining special privileges chiefly from fear of what might happen to their interests and nationals in China if these were surrendered while China still is so disorganized politically. On Jan. 28, 1932, following disputes over the boycotting of Japanese goods, Japanese marines landed at Chapei, adjacent to the Japanese section of the International Settlement. The ensuing conflict lasted for 40 days in spite of the efforts of the League of Nations and the World Powers to intervene. On May 5, China and Japan signed a truce agreement.

While these political developments were going on after the establishment of the Republic, marked changes were taking place in other fields. Because of the long-established practice of confining governmental activity to as narrow limits as possible, in fact, the political disruption has interfered comparatively little with the economic, educational, and social progress generally—though unquestionably this progress would have been much greater if there had been political order and peace throughout the country. The

virtual failure of the Republic in its first years brought a wide-spread feeling of hopelessness among the younger enthusiasts, but beginning roughly in 1917 a new spirit of determination to improve conditions showed itself. This was marked by a turning away from attempts to achieve perfection at a jump or by passing resolutions and adopting constitutions. Instead there has developed a growing readiness to move forward more securely if more slowly through carefully thought-out steps. Particularly significant were such developments as the so-called "literary revolution" which succeeded in establishing the spoken language as a standard literary medium; the growth of modern industry; the increasing use of modern methods in business and finance; the improvement of means of communication which made possible the development of trade in foreign-style goods in the far interior; the adaptation of modern educational methods to China's particular needs; and, perhaps most significant of all, the increasing realization of the fact that sound progress can best be made toward order and social stability by building on foundations laid deep in Chinese life and not by copying wholesale from the West. G. C.

BIBLIOGRAPHY.—F. Hirth, *The Ancient History of China*, 1908; Henry Cordier, *Histoire générale de la Chine et de ses relations avec les pays étrangers*, 1920; Hu Shih, *The Development of the Logical Method in Ancient China*, 1922; H. B. Morse, *The International Relations of the Chinese Empire*, 1927; Sun Yat-sen, *Sun Min Chu I* (English translation by Price and Chen, 1927); E. T. Williams, *A Short History of China*, 1928; Payson L. Treat, *The Far East*, 1928; Richard Wilhelm, *A Short History of Chinese Civilization*, 1929; K. S. Latourette, *The Development of China*, 4th ed., 1929; A. N. Holcombe, *The Chinese Revolution*, 1930; M. T. Z. T'au, *Two Years of Nationalist China*, 1930; *The China Year Book*, 1913-1931; various collections of treaties with and concerning China, such as those made by the Chinese Maritime Customs and J. V. A. MacMurray.

CHINA-BERRY (*Melia Azedarach*), called also China-tree and pride of India, a handsome spreading tree of the mahogany family. It grows 40 ft. high, bearing large divided leaves, fragrant purple flowers and yellow berry-like fruit. It is a native of south-western Asia and widely cultivated in warm regions as an ornamental tree. The Texas Umbrella-Tree (var. *umbraculiformis*), much grown in the South, is a form of the China-berry.

CHINA FOUNDATION FOR THE PROMOTION OF EDUCATION AND CULTURE, **THE**, the Sino-American organization, with headquarters in China, which administers that portion of the American share of the Chinese Boxer Indemnity which was remitted in 1924. The foundation has a self-perpetuating board of fifteen trustees, of whom ten are Chinese and five American. The money under its control is used for educational development in China, particularly for the development of education in the physical sciences.

CHINA HAT, a sub-tribe of the Kwakiutl occupying Tolmie Channel and Mussel Inlet in British Columbia. They speak a dialect of Heiltsuk which is itself one of the linguistic subdivisions of the Wakshan linguistic stock.

CHINA SEAS, the enclosed waters off the east coast of China and Indo-China, consisting of the Yellow, East China and SOUTH CHINA seas. The Yellow Sea is a broad inlet penetrating between the mainland and Korea, and opening into the East China Sea. The latter is separated from the Pacific by the islands of the Japanese Empire, and communicates through Formosa Strait with the South China Sea which lies behind the Philippines and Borneo.

CHINAWARE, a name for porcelain, used in Europe in the 17th century to distinguish the wares imported from China and the East from pottery made in Europe at that time. Since the invention in England by Josiah Spode, toward the end of the 18th century, of bone porcelain, a mixture of china clay, bone ash and flint, the term "chinaware" has come to refer to this product. Spode's formula was adopted by the chief manufacturers in England. The center of the chinaware industry was located in Staffordshire, and in these factories a technique in china manufacture was developed at such a low price of production that all competition was destroyed and a world market was established. Much of this market has been retained and Staffordshire ware remains the standard for bone porcelain. Staffordshire chinaware differs from porcelain in several respects, and in some ways is more attractive.

CHINCHA ALTA, a city of Peru, and capital of the province of Chuncha, situated near Tambo de Mora with which it is connected by electric railway. The products of the surrounding district are cotton and fruit, especially grapes. The city has cotton gins, soap factories and wine manufactories. Its supplies are brought from Lima. Est. pop., 1927, 20,000.

CHINCH-BUG, a small white-winged dark colored, American insect (*Blissus leucopterus*) of the family *Lygaeidae* and one of the worst pests of agriculture. It may occur in such myriads as to destroy whole fields of cereals and grasses, especially in the Mississippi Valley. In spring the females lay about 500 eggs each on the stems and leaves. The nymphs, which are red at first, suck the juices till midsummer when the grain loses its juiciness. They then migrate on foot in large bodies to corn or other still succulent grass and soon mature. A second brood develops in early fall and passes the winter. No specific control is known but several methods are helpful. Deep and thorough plowing in early fall will bury the adults. Destroy hiding places such as corn shocks and grass and weeds in fence rows in late fall. In dry weather a dust furrow with deep holes may be helpful.

CHINCHILLA (*Chinchilla*), a small rodent whose gray fur, which is dense, soft and lustrous, is highly prized for garments. The kind called pika-squirrel, which inhabits the Andes in Chile and Bolivia at considerable heights, is the one more commonly used. Exclusive of the long bushy tail, it is about 10 in. in length and has large ears. The short-tailed chinchilla, found in Peru, has a larger body, and smaller ears. Chinchillas live gregariously in holes among

the loose rocks or in burrows that they excavate. Their fare consists mainly of roots and grasses. They run like mice, eat like squirrels, and are on the guinea-pig's level of intelligence. Since it takes many pelts for a single garment, chinchillas are caught in vast quantities and are decreasing in number. Yet owing



CHINCHILLA

to their fecundity, they still exist in abundance. The natives hunt them with a kind of weasel that enters their burrows.

CHINCH-WEED (*Pectis papposa*), a low, smooth, much branched annual of the composite family, abundant in sandy deserts from Utah and southern California to Mexico. It bears narrow leaves with bristles at the base, and numerous small heads of bright yellow flowers. The herbage has a strong disagreeable odor, somewhat resembling that emitted by the chinch-bug.

CHINESE-AMERICAN TREATY, the first treaty between the United States and China, concluded July 3, 1844 and proclaimed Apr. 18, 1846. Caleb Cushing, Envoy Extraordinary to China appointed by President Tyler, arranged with the Ta Tsing Empire, represented by Tsiyeng, "Superintendent General of the Trade and Foreign Intercourse of the Five Ports," a treaty of 34 articles, mostly pertaining to maritime and commercial rights and privileges. A lengthy schedule of tariffs upon American goods landed at Chinese ports was appended, this tariff to be modified only with the consent of American consuls or other authorized functionaries of the United States. Citizens of the United States were to be permitted to frequent, reside, and trade in the five approved ports of Fuchow, Kwang-Chow, Amoy, Ningpo and Shanghai, but other Chinese ports were strictly forbidden. The first article of the treaty was a statement of purpose: to establish "perfect, permanent and universal peace and a sincere and cordial amity" between the two nations "without exception of persons or places."

CHINESE AND JAPANESE ARCHITECTURE. The development of Chinese architecture has been a simple and orderly one, and like the life and thought of the race, has absorbed invading influences and been revived by them. It is an architecture akin to the Greek, based on lintel and supporting columns harmoniously proportioned, but differing in that the emphasis is on the width of the building rather than on the depth. Both races made

CHINAWARE



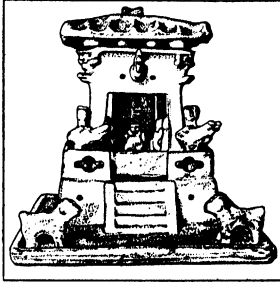
COURTESY COPELAND & THOMPSON, INC., NEW YORK

EXAMPLES OF RARE SPODE CHINA

1. Jugs and beaker with hunting and drinking scenes in relief against a blue ground, by Turner. 2. Plate of the "Italian pattern," produced by Josiah Spode in 1797. 3. Old stone china plate decorated with peacocks and peonies in color, known as "Spode Peacock." 4. Porcelain plate, stone

colored ground on rim with center painted with purple anemones and blue hyacinths. 5. Plate in wedding service of King Edward and Queen Alexandra; borders of open work, reticulated. 6. Historic service made at Chelsea in 1763 by order of Queen Charlotte and reproduced by Spode.

use of polychrome decoration and of irregularities of construction, but there is no proof that the irregularities of Chinese construction were deliberate. Discussions of the origin of Chinese architecture are a matter of hypothesis. The earliest definitions state firmly and incontrovertibly that "a tower is a tower,



COURTESY PARISH-WATSON & CO., NEW YORK
CHINESE POTTERY MORTUARY GROUP,
REPRESENTING PAVILION WITH PER-
SONAGES

Han Period (206 B.C.-220 A.D.)

a gate is a gate"; by the earliest visual records in the tomb potteries of Han, 206 B.C.-220 A.D., and the reliefs of the Wu tombs, 2nd century A.D., indicate that they used a combination of mud and wood from the start, and that the tile roofing of alternating concave and convex rows was in imitation of split

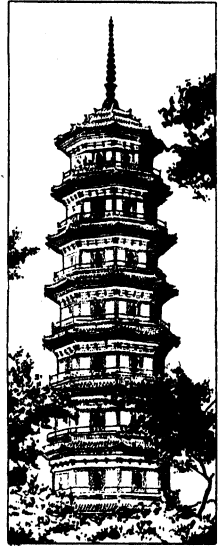
bamboo. The lovely curvature of the roofs varies from north to south, obviously because of climatic conditions. The forms of architecture which must have been developed already by the Han Dynasty were dwellings; palaces, or square, round and longitudinal pavilions; walls and fortifications, as bastions, bell towers, drum towers and signal towers; altars and tombs, and ceremonial arches, or *p'ai lou*.

The Forbidden City.

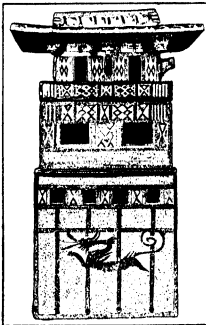
With these things to start on, enriched by the modified Buddhist *pagoda* forms, Chinese architecture developed a variety of related forms which culminated in the Tse Chin Cheng, or the Forbidden City of the North Star, and its attendant gardens in Peking, which were begun in 1416 for the third emperor of the Ming Dynasty, Yung Loh. This monument is rapidly being recognized as one of the great, if indeed not the greatest, pieces of ground planning in the world. The Forbidden City itself is an integral part of the Im-

perial City, which is again related to the so-called Tartar walls of the city proper. It is approached through the double city gate, Ch'ien Men, inside of which is a small plaza on which opens the low dynastic gate of the Imperial City. Inside this, a long plaisance leads to T'ien An Men, or the Gate of Heavenly Peace, in front of which stand the emblematic lions and columns and the five marble bridges of the Chin Shui, or Golden Water. The T'ien An Men itself consists of a block of masonry pierced by five gates and surmounted by a great hall of nine divisions, or *chien*. The brick construction is faced with an orange red plaster which in the late afternoon light turns rose red. This is surmounted by a balustrade of Chihli marble which has changed from white to cream color. The hall itself is painted the typical lacquer red, with the cross-beams and crocket-like decorative brackets covered with variegated patterns in which green and blue set off with white and gold predominate. The sloping roof is covered with glazed tiles of gamboge, very uneven in intensity and changing in value with every hour of the day. This is the color scheme which is carried out throughout the main buildings of the Forbidden City, save for a few exceptions such as the Chieh Fang T'ien, or Palace of the Princess, which is roofed with glazed tiles of a clear green.

Behind the T'ien An Men is a vast introductory courtyard leading to a similar gate, Tuan Men, or Gate of Uprightness, beyond which an even larger courtyard leads to Wu Men, or Gate of Wu, a hollow square surmounted by three rectangular and four square pavilions. Directly north of Wu Men, across the courtyard, is the T'ai Ho Men, or Gate of Infinite Harmony, a low gate which leads to the great state halls. Of these there are three, the T'ai Ho Tien, or Hall of Infinite Harmony; the Chung Ho Tien, or Hall of the Heart of Harmony, and the Pao Ho Tien, or Hall of Protecting Harmony. These stand on the third terrace. Beyond the T'ai Ho Men the three great throne halls stand on a triple terrace laced with balustrades, as if on an island. They are approached by a triple stairway on the south, which is repeated on the north. The roofs to the east and west rise in varying heights and varying shapes. North of this group, the whole central series is repeated on a smaller scale, terminating in a garden



FLOWER PAGODA, CANTON



COURTESY C. T. LOO, ESQ.,
NEW YORK CITY

TERRA COTTA MODEL OF A
TOWER

*Polychrome painted brick of
the Han Period*

and the great gate, Shen Wu Men, or Gate of Divine Military Prowess, and from the T'ien An Men to the Shen Wu Men, the spaces north and west of the central group are filled with palaces and temples. At the north of the Forbidden City is the Ching Shan, an artificial five-peaked hill, and to the west are the lake palaces and gardens. The whole scheme contains examples of almost every form of Chinese architecture save the tomb and pagoda forms.

Temples and Altars. The characteristics of the typical Chinese temple or palace hall are: large,



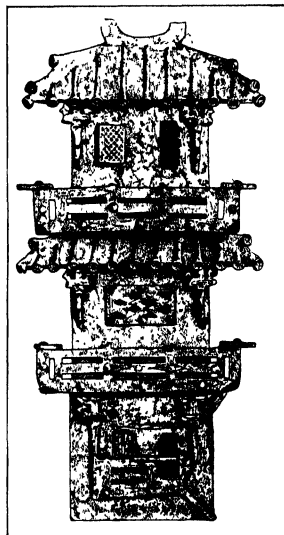
COURTESY M. M. OF ART

A T'ANG PALACE (1368-1644 A.D.)

round wooden supporting columns, with walls only as screens; broad projecting eaves supported by a double system of rafters on a multitude of small branching brackets; heavy cross girders supporting vertical posts that carry the roof construction; roofs either entirely hipped, or partially hipped and partially gabled, with rows of animals and dragon finials on the hip tiles; ceilings of square panels; and doors and windows of rich wooden grille work. Temples follow the palace plan with carefully balanced gates, courtyards and halls; but the great square and the round altars with stairs and balustrades are a purely Chinese development. Of these, the most impressive is the T'ien Tan, or Altar of Heaven, the round type, with its triple terraces, marble balustrades and ceremonial gateways. This altar is supplemented by two circular temples with a connecting raised avenue, by the temple Chai Kung, or Hall of Abstinence, where the Emperor fasted the night before the New Year's ceremonies, and various service buildings. It is surrounded by a magnificent formal park and a red wall with yellow tiles which in turn is surrounded by groves and meadows and enclosed by a second wall. The entrance faces the entrance to the Hsien Nung T'ien, or Temple of Agriculture, so that from the first step through the gate of the outer city, one is aware of the majesty of the capital city.

The great monasteries and hill temples, while formal in their main series of courtyards, are treated with great variety in order to harmonize with their natural surroundings. In fact, the site chosen becomes the natural plan of the temples; pavilions and grottos appear wherever there is peak or knoll or mountain spring. The result is altogether enchanting, and the traveler coming upon one for the first time is astonished at the realism of Chinese painting, which the westerner has been taught is pure imagery.

Influence of Buddhism. The development of this architecture was from an original simplicity toward an increasing elaboration of ornament, and in the Ch'ing Dynasty, toward more delicate and flimsy proportions. The latter was partly due surely to the increasing difficulty and expense of procuring large timber. The course can easily be followed by a comparison of the monuments or pictorial records of the monuments of the Han potteries and the tomb reliefs of the Wu family. By the 6th century A.D. the influence of Buddhism had started the great series of



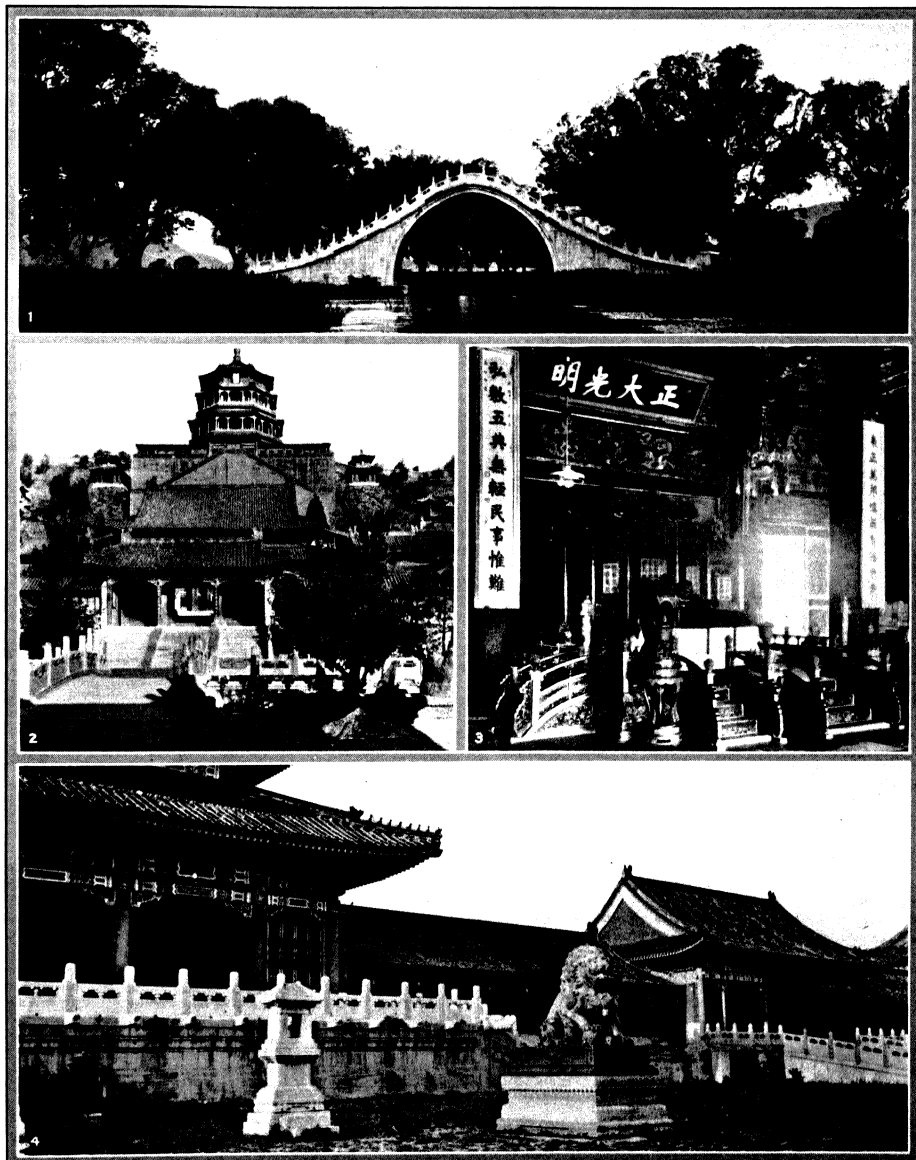
FROM PHOTO: FOGG ART MUSEUM HARVARD UNIVERSITY

GUARD TOWER USED AS GRAVE FURNITURE
Han Dynasty (206 B.C.-220 A.D.)

cave temples. These consisted of wood porticos, small anti-chambers cut into the rock or earth, and large secondary chambers for the main altars. In the earlier days the latter was often cut around a square core pillar with the important altars on the four faces. The entire surface except the floor was covered with polychrome decoration, carved out of solid stone at Yun Kang, begun in the early 5th century, and Lung Men, begun in the late 5th century, and covered with mud and a thin layer of painted plaster at Tun Huang, begun in the 5th century, or possibly earlier, where the cliff is of closely packed gravel. At the latter place, the main deities are of mud covered with a thin coat of plaster, which is then painted. The effect is that of the all-over carved surface of a Gothic cathedral turned inside out. Buddhism brought the pagoda and the bottle-shaped dagoba forms, the latter always of a mortuary nature.

The more important monuments of cave temples

CHINESE AND JAPANESE ARCHITECTURE



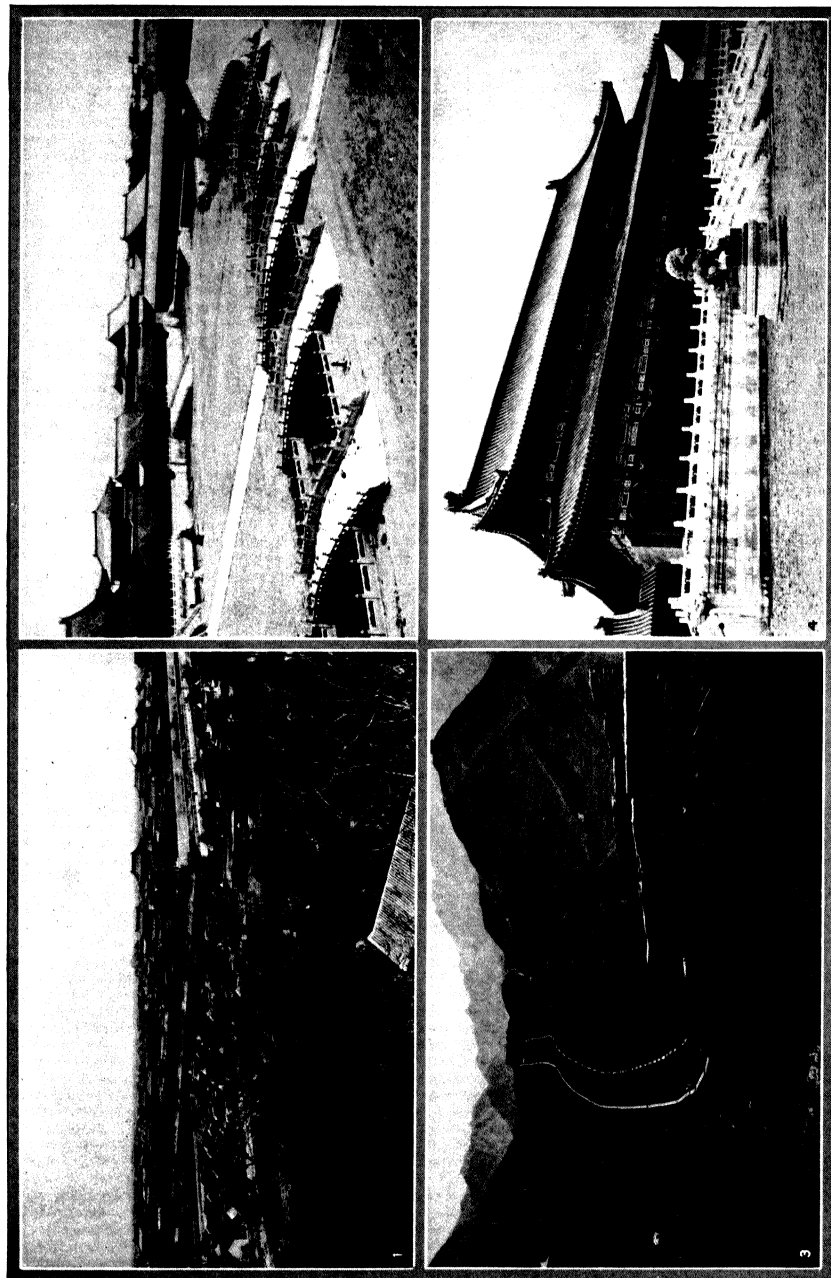
1. COPYRIGHT E. M. NEWMAN. FROM PUBLISHERS' PHOTO SERVICE; 2. COPYRIGHT L. GREEN. FROM PUBLISHERS' PHOTO SERVICE; 3. ORIENT AND OCCIDENT PHOTO; 4. BY BEWM. FROM ORIENT AND OCCIDENT

CHINESE ARCHITECTURE

1. The Camel Bridge, an exquisite conception in marble crossing the sacred Lotus Lake of the Summer Palace near Peking (Peiping). 2. The Summer Palace, built by the

Empress Dowager in the late 19th century. 3. The throne of the former Manchu emperors in the Forbidden City, Peking. 4. A gate hall of the Forbidden City.

CHINESE AND JAPANESE ARCHITECTURE

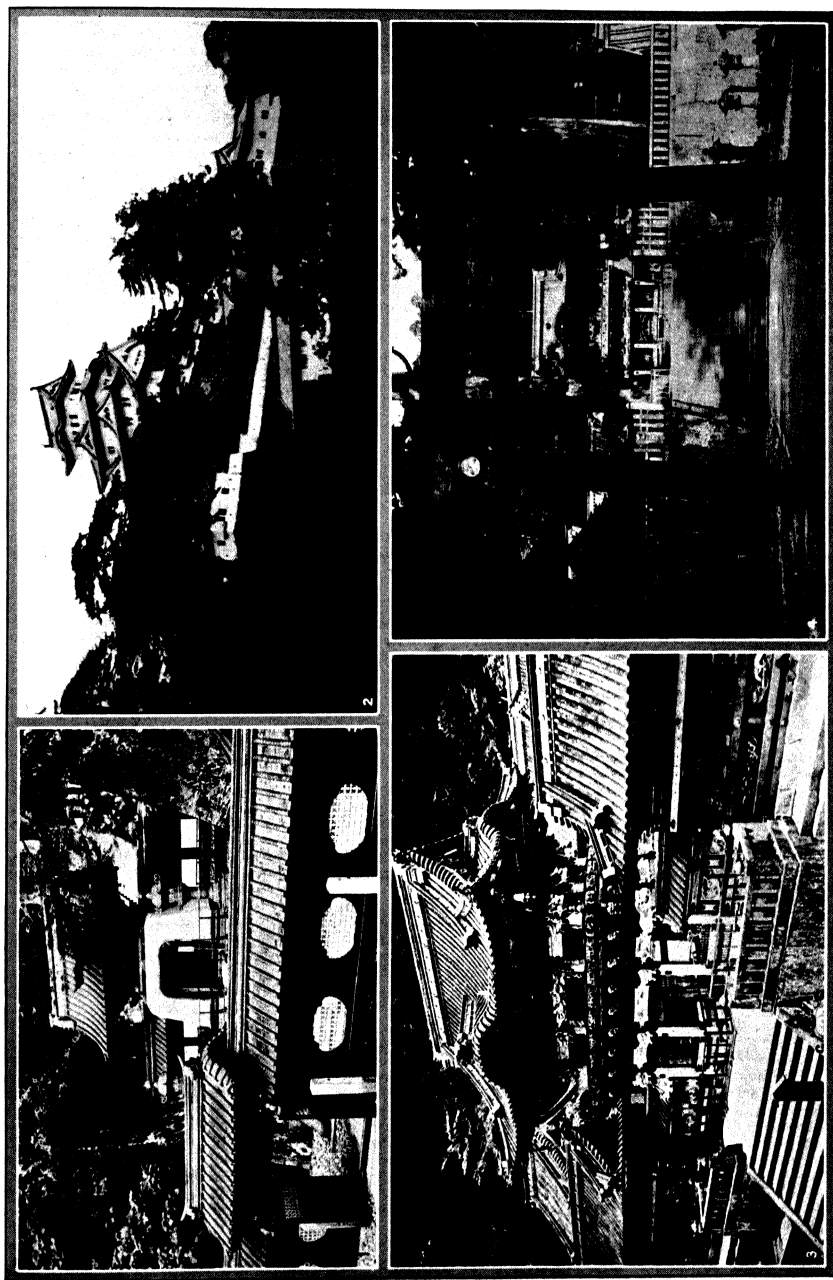


1. BIRD'S-EYE VIEW OF PEKING (PEIPING) FROM THE WINTER PALACE. 2. FIVE MARBLE BRIDGES ACROSS A MOAT IN THE FORBIDDEN CITY, PEKING.

NORTHERN CHINESE ARCHITECTURE

3. THE GREAT WALL OF CHINA, A SQUARE WATCH-TOWER IN THE BACKGROUND. 4. THE HALL OF THE THRONE IN THE FORBIDDEN CITY, PEKING.

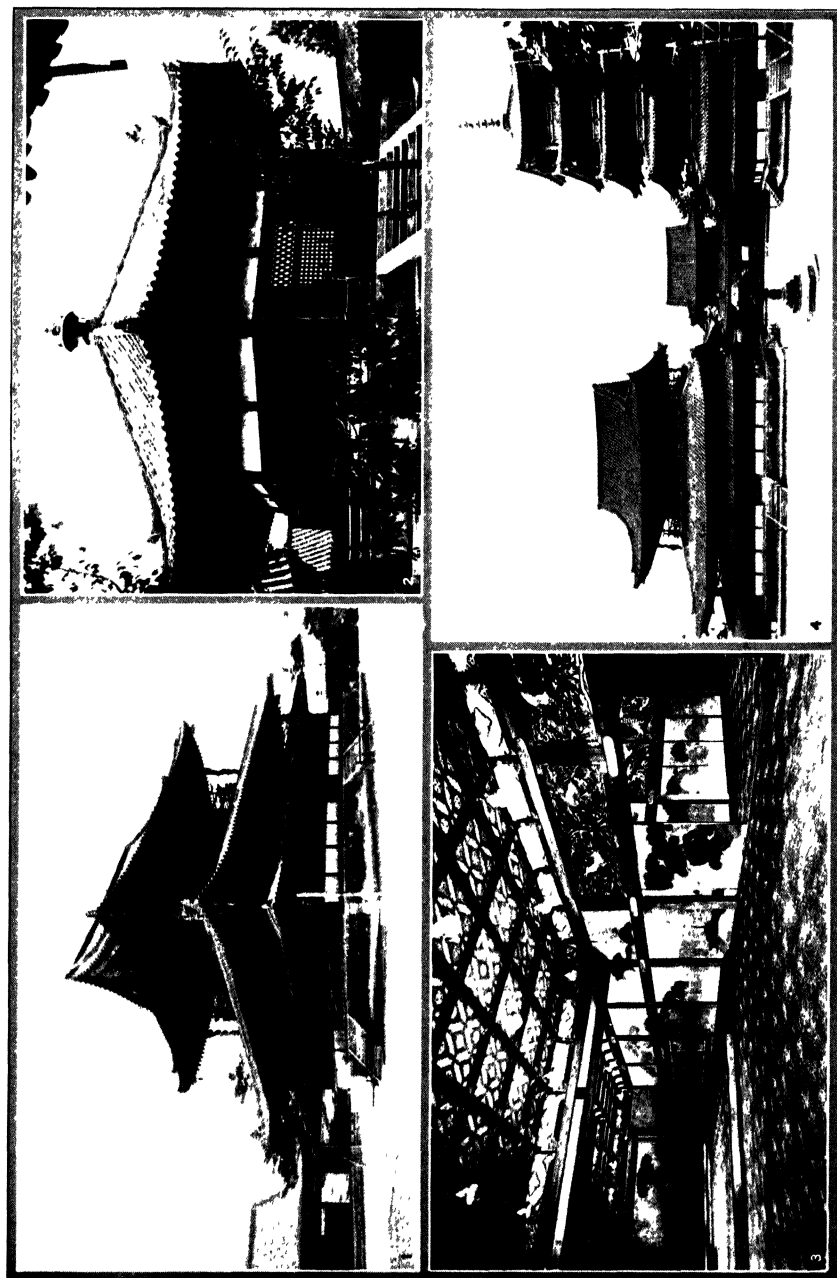
CHINESE AND JAPANESE ARCHITECTURE



CHARACTERISTIC JAPANESE ARCHITECTURE

1. Tomb in the grounds of a Nikkō shrine. 2. "Snowy Heron Castle," a fortress dating from 1340, at Himeji.
3. The main gate of Nikkō Temple. 4. A torii of a Nikkō shrine.

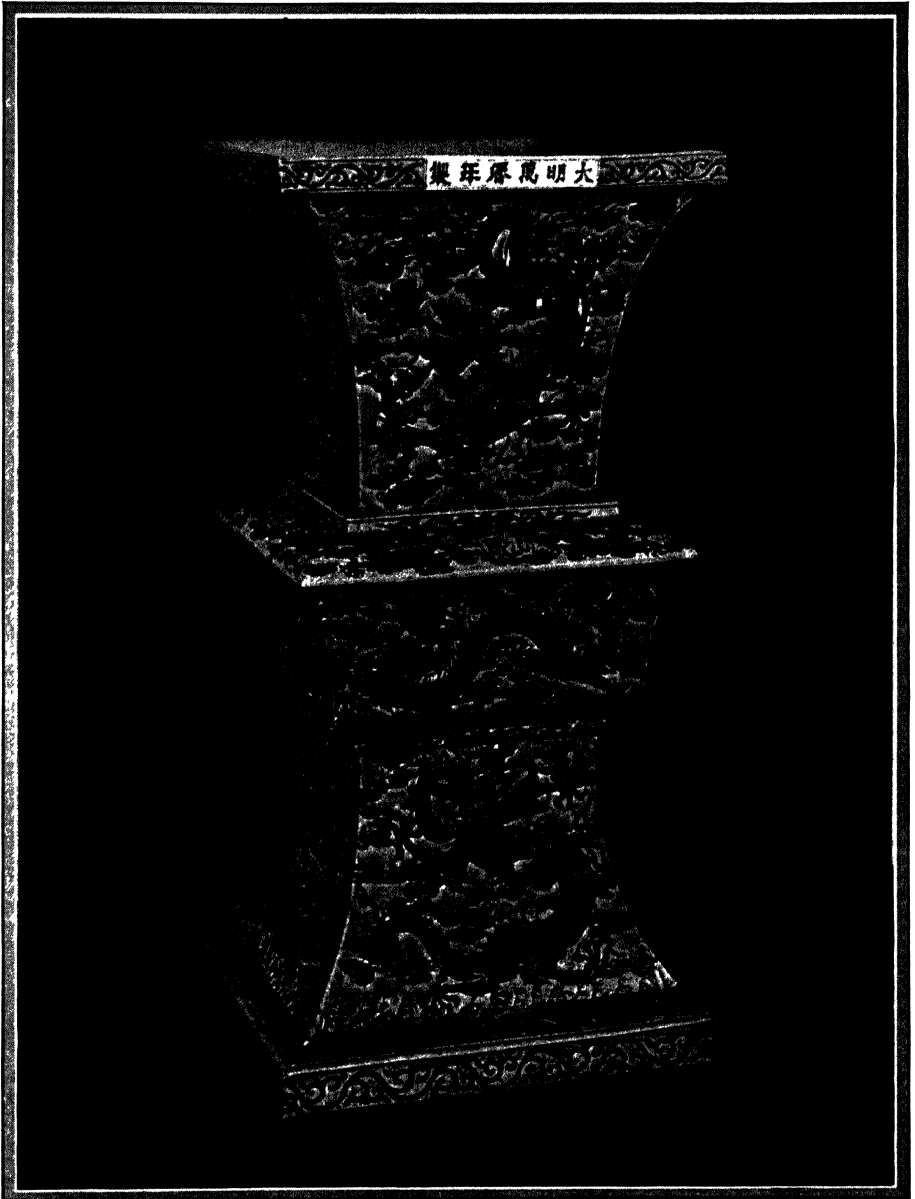
CHINESE AND JAPANESE ARCHITECTURE



JAPANESE ARCHITECTURE IN PALACE AND SHRINE

1. The famous Golden Tower of Hōr-ū-i Temple, an ancient Buddhist shrine founded in 607 A.D.
2. The Hall of Dreams, Hōr-ū-i Temple, some of which are said to be the oldest in the world.
3. Hall of the Imperial Palace at Tokio
4. Pagodas of Hōr-ū-i Temple, some of which are said to be the oldest in the world

CHINESE ART



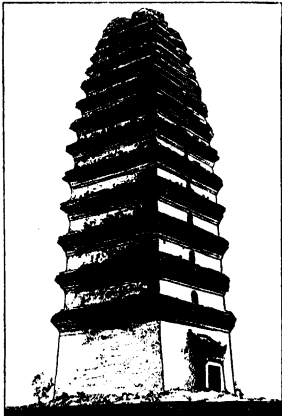
COURTESY C. T. LOO FSO.

CHINESE VASE OF THE MING DYNASTY

According to the inscription, this vase, one of an altar set, was made in the reign of Emperor Wan Li (1573-1619)

are Tun Huang, Yun Kang, T'ien Tai Shan and Lung Men, and there are ghostly remains of vast series in Kansu. The free-standing temples are innumerable; but in most cases the dates are unreliable. The memorial tablets of the founding of the temples do not necessarily indicate the real founding, and they have stood through many burnings and rebuildings of the actual temples. The Hsia Hua Yin Ssu at T'a Tung Fu in Shensi is held by competent authorities to be of actual Sung construction. The temples of the Ming and Ch'ing Dynasties can many of them be dated with some accuracy, especially in the neighborhood of Peking, and the Wu T'ai Shan in Shansi, which in itself offers a great opportunity for study.

The Mohammedans introduced the arch form used extensively in the gates of the Forbidden City and the domed square chapel. Vaults as early as the

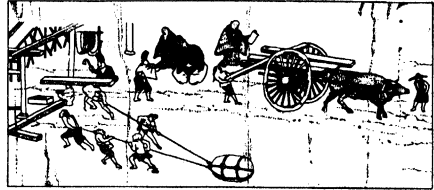


SMALL WILD GOOSE PAGODA AT SIANFU,
SHENSI PROVINCE, CHINA

8th century occur in the "Wild Goose" pagodas at Sianfu, in Shensi; and on a large and monumental scale in various temple halls of the later Ming period, such as the unusual masonry temples of Kin Tze and Shuang Ta Sze at Taiyanfu, Shensi. The Ch'ing Dynasty introduced more elaborate Indian forms via Tibet, such as the Wu T'a Ssu, in Peking, and the Lama monastery at Jehol, done in direct imitation of the Potala at Lhasa. From the reign of K'ang Hsi, Chinese architecture was influenced by the Italianate-French architecture of the period. A whole series of palaces called the Yuan Ming Yuan, or the Round, Bright Garden, was put up outside Peking, and the Italian form of staircase was used in Ch'ien Lung's noble summer palace, which was destroyed by the British in 1860.

Chinese Influence in Japan. Japanese architecture was derived from the Chinese via Korea and is fortunate in preserving some of its earliest monuments, notably the square Kondo, or Golden Hall,

of the monastery of Horyuji, 607 A.D., outside Nara. The form here is of small halls raised on platforms with large and small bracket-crocks in the cornices. Having accepted this early form, the Japanese developed their own system of decoration, tending to an exterior perfection of lacquer surface, and interior broad surface of screens of rich but simple design, culminating, in their temples, at Nikko, and in civil architecture, in the Nijo castle, 1602-03, at Kyoto. In the environs, the landscape design and the gardens clung to an emphasis on sophisticated simplicity and



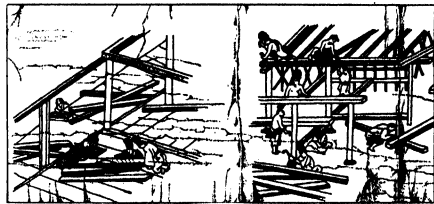
COURTESY M. N. OF ART

REBUILDING OF THE PALACE

Attributed to Sumiyoshi Keinin, Kamakura Period (1166-1200)

naturalism. In general, Japanese plans are more informal than Chinese, with a less monumental insistence on symmetry.

Variation of Architecture. To return to a general consideration of Eastern architecture, it is time to protest against the criticism which is almost invariably brought against it by writers on the subject, namely the charge of monotony. Here observers have been misled by the vast numbers of extant buildings



COURTESY M. N. OF ART

REBUILDING OF THE PALACE

From a Japanese drawing of the Kamakura Period attributed to Sumiyoshi Keinin (1166-1200)

belonging to one school of architecture, whereas the truth of the matter is, Chinese architecture is as varied as either the Greek or the Gothic, and the fact that China has developed and waned in one great harmonious arc instead of hobbling up and down from Greek to Roman, Roman to Gothic, Gothic to Renaissance, and from Renaissance to muddled eclecticism, will hardly tell against her when scholars consider world architecture.

Another point which is an integral part of the understanding of Far Eastern architecture is the symbolism and thought which govern it. In undertaking

any Chinese building, the first consideration is the *feng-shui*, which is translated literally "wind and water" but which stands for all the psychic forces which affect a given site. Inasmuch as the *feng-shui* requires a south-facing exposure whenever possible, the result is comfortable, and if upon occupation of a building, the *feng-shui* turns out to be unfavorable, drastic measures such as special temples and spirit screens are employed. The ground plans should be laid out at night with an instrument which is sighted on the north star, bringing the projected building not only into proper relationship with the earth and its forces, but into harmony with heaven and the entire universe as well. From first to last, the growth of a Chinese building is considered with this pleasing play of thought, in the simple dwelling as well as in temples and palaces.

A. P.

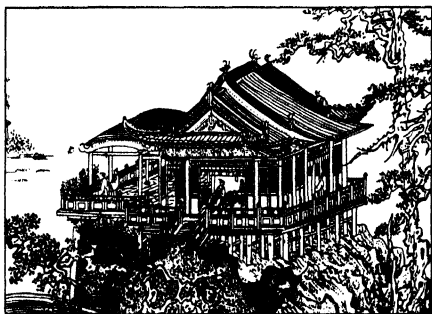
BIBLIOGRAPHY.—Stephen W. Bushnell, *Chinese Art*, 1910; Oswald Siren, *A History of Early Chinese Art*, 1930; Ernst Boerschmann, *Chinesische Architektur*, 1925; Okakura & Warner, *Japanese Temples and their Treasures*, 1909; Franz Baltzer, *Die Architektur der Kultbauten Japans*, 1907; R. A. Cram, *Japanese Architecture*.

CHINESE ART. The origins of Chinese art are obscure. There were portraits as well as bronzes and pottery in the 14th century B.C., but little can be stated definitely until more than 1,000 years later. When Chinese painting emerged it showed an ease and authority that comes only from practice, so it is a safe surmise that schools had been in operation during the long interval preceding. The medium was ink, and handwriting, regarded as an equally important art, formed a prominent part of the composition. Panels were sometimes painted but the usual surface was paper and silk, which had rods at top and bottom

realism of European schools seemed to them gross and material. Influenced by Babylonia, Persia, India and Greece, Chinese art retained its own particular genius. After the Ming dynasty (1368-1644) religious subjects grew less popular and *genre* pictures appeared. The decorative style continued but it had become over-elaborated, always the sign of artistic decadence, and painting lost its old inspiration. The Chinese themselves valued their sculpture less than their painting. As in the latter, they were influenced by other nations, particularly by Greece and India, but as before, art never lost its symbolic meaning. There were innumerable religious subjects, richly painted or gilded; the five manifestations of Buddha, Bodhisattva, a being who approached the high spiritual state of Buddha himself, Kwannon, the Goddess of Mercy, holding a child like the Christian Virgin, the Arhats, disciples, and the Rishi, or wizards, sometimes represented as beasts or plants. The dragon, so often encountered, is the sign of spiritual strength, just as the tiger is the sign of the material and worldly. After the 15th century sculpture suffered from a profusion of ornament and declined. Despite the beauty of some of their architecture, the Chinese were never first class in conception or execution. They used wood in general, and accordingly have no buildings older than the 11th century. Buddhism, little concerned with transitory human existence, was indifferent to the erection of enduring buildings. The great wall was used solely for protection which is the sole reason for its solidity. Common forms in architecture are the heavily roofed structure known as the Ting, the great gateway, the Pail-lou, commemorating a celebrity, and the tower known as the Pagoda. In ceramics and in porcelain, which they invented, the Chinese are unexcelled and show a wide diversity of design and great beauty of color. As artificers in jade, rock crystal and wood their art objects have amazing finish and fantastic conception.

BIBLIOGRAPHY.—B. Laufer, *Chinese Clay Figures*, 1914; R. L. Hobson, *Chinese Art*, 1927; John C. Ferguson, *Chinese Painting*, 1927.

CHINESE CUSTOMS CONFERENCE, the gathering at Peking, 1925-26, to consider the revision of treaties concerning China's customs tariff. At the WASHINGTON CONFERENCE, 1921-22, China had made a strong plea for tariff autonomy. It was agreed that within three months after the ratification of the Washington Conference treaties a conference would be held to consider the question. France held up ratification, so that the customs conference did not meet until Oct. 25, 1925. The Chinese immediately demanded full tariff autonomy. A resolution was agreed on, to be embodied in a subsequent treaty, granting China tariff autonomy beginning Jan. 1, 1929, and pledging China to cancel *likin* at the same time. Political confusion in China led to the break-up of the conference before the final treaty was drafted, but the Chinese acted on the assumption that the date mentioned in the resolution would be the end of the treaty limitation of China's right to fix her own tariff.



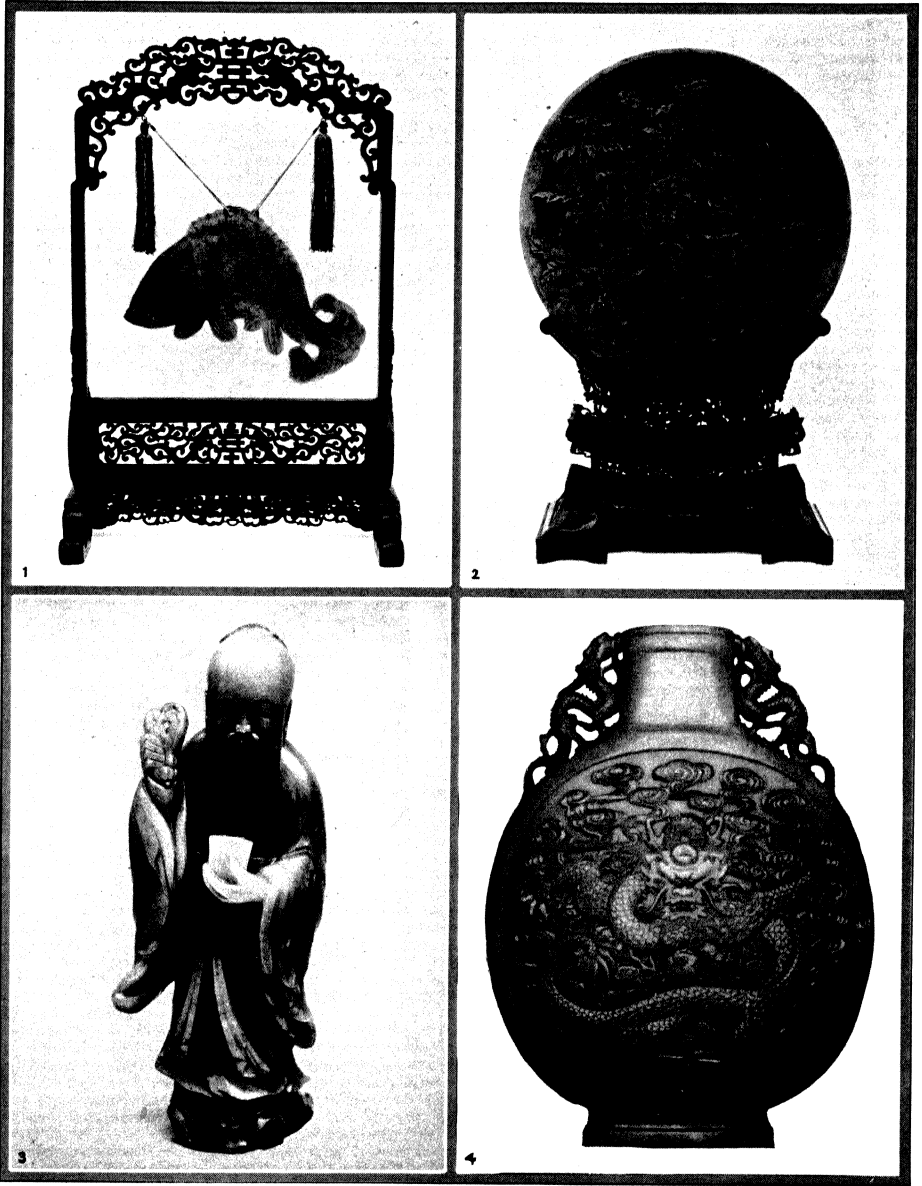
COURTESY M. M. OF ART

A PAVILION ON A LAKE

From a painting, of the Ming Dynasty attributed to Li Sung

to keep the picture flat. During the earlier dynasties Chinese painting was of a religious character. BUDDHISM inspired artists with a detached, poetical conception of landscape, flowers, clouds and the sea, for to them the eternal mystery of nature was sublime compared to the ephemeral life of man. The Chinese approach to art was through the decorative, their conception of the world was benign, and so the literal

CHINESE ART



COURTESY METROPOLITAN MUSEUM OF ART

CHINESE JADE CARVINGS

1. Fish gong of the K'ang-hsi Period (1662-1722). 2. Circular jade panel from the Imperial Summer Palace.

3. Taoist figure of nephrite. Ch'ien Lung Period (1736-95). 4. Pilgrim bottle of nephrite. Ch'ien Lung Period.

CHINESE ART

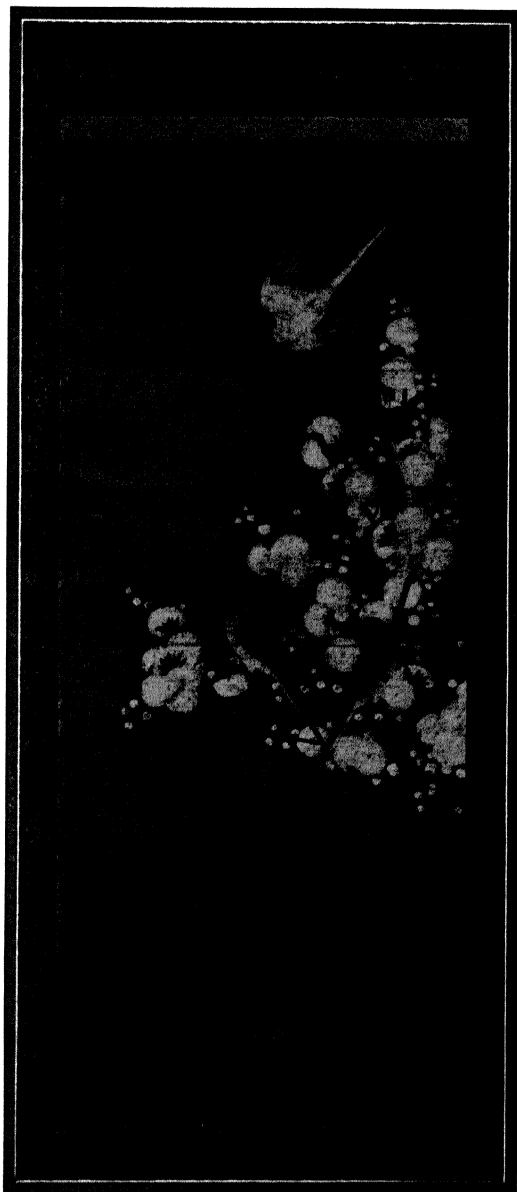


COURTESY METROPOLITAN MUSEUM OF ART

CHINESE ART OF THE TWELFTH AND SEVENTEENTH CENTURIES

1. Flowering hibiscus and white egret, in autumn. A Yuan dynasty painting by Chao Tze Ku (1199-1295).
2. Ducks and lotus. A water color painting of the Ming period, attributed to Chou Chu'uan, who flourished in 1630-50.

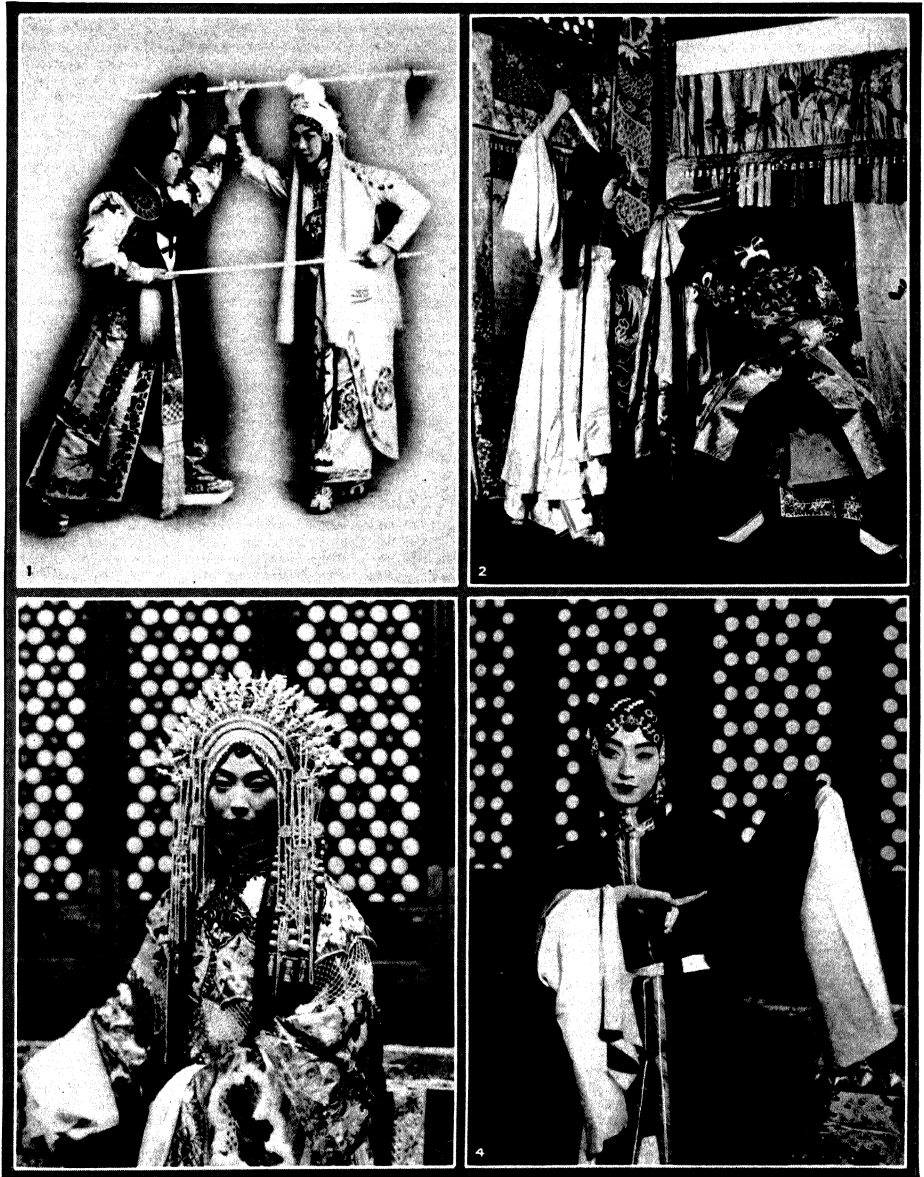
CHINESE ART



PARROTS IN A FLOWERING TREE

A print of the Ming Dynasty (1368-1644), China. In the Metropolitan Museum of Art.

CHINESE DRAMA



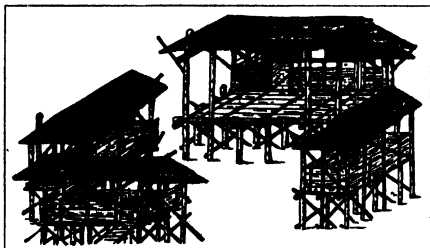
1. COURTESY KATE BUSS. STUDIES IN THE CHINESE DRAMA (JONATHAN CAPE & HARRISON SMITH, 1930); 2, 3, 4. PHOTOS BY VANDAMM

CONVENTIONALIZED POSTURES OF THE CHINESE DRAMA

1. Mai Lan-fang, celebrated actor, in "The Rainbow Pass." 2. Killing the General in "The Bandit General."
3. Mai Lan-fang wearing a rich costume used in "The Bandit General." 4. "The Suspected Slipper."

CHINESE DRAMA. The traditional origin of the Chinese theater is the "Pear Garden" established by the T'ang Dynasty emperor, Ming Huang (713-56), a place for dramatic performances given to delight his concubine, Yang Kuei-fei, China's most famous beauty. Recent critical research, however, has proved that play-acting in China is very much older, and as in Greece and medieval Europe, of religious origin, in the case of the Chinese probably connected with ancestor worship.

No dramas written before the Yuan Dynasty (1280-1368), the so-called golden age of the Chinese drama, are preserved. It was at this time that Chinese



COURTESY JONATHAN CAPE & HARRISON SMITH

TEMPORARY CHINESE THEATER OF MATS AND BAMBOO
From Kate Buss, "Chinese Drama"

scholars, ousted from their official positions by the Mongol conquerors, turned to the previously despised literary form of the drama and composed the classical Yuan Dramas of which 116 are preserved. They were generally composed in four acts and, in addition to the spoken parts advancing the action, had emotional passages which were sung, somewhat analogous to the choral odes in the Greek drama. The drama of the Ming Dynasty (1368-1644) was much looser in construction than the Yuan Dramas, but showed a profounder conception and better characterization. During the Ch'ing Dynasty (1644-1911) dramatizations of popular novels dealing with China's period of chivalry in the 3rd century conquered the stage and drove out the classical drama almost entirely. Chinese drama, even at its best, does not attain the level of Chinese painting or lyric poetry. Dramatic economy and a sense of the tragic are lacking.

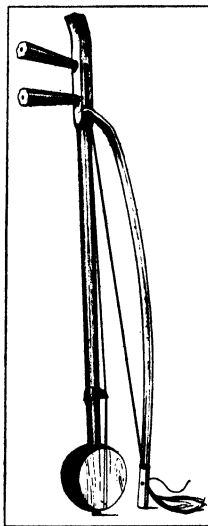
The Chinese stage, as well as the manner of production of the plays, is strikingly like the Elizabethan. A curtainless platform, without scenery and with practically no properties, projects into the auditorium on which the action proceeds. Very elaborate and colorful costumes, however, give the stage an appearance far from bare. Numerous fixed conventions are employed to inform the spectators of the place, the time, and the identity of the characters. Since the 18th century women's rôles have been played by men, a convention now changing along with many others through Occidental influence, most strongly felt in the ports. There are stock character types in the Chinese drama somewhat similar to those of the Italian *com-*

media dell' arte, chief of which are the old man, the military hero, the ingenue, the old woman and the clown. One division of plays includes the military and civil. In the military plays, scenes of warfare are enacted usually in dual combat, the movements of the fight being extremely conventionalized and set to musical accompaniment. The whole somewhat resembles ballets. Among the civil plays are historical pieces, family drama, fairy or mythological plays, dramas of character, religious drama and similar divisions. The Chinese also divide their plays according to the kind of music employed in them, the styles of music being named generally after the province in which they originated. The influence of the Chinese theater on the western drama is extremely slight, whereas, since the founding of the Republic in 1911, the Chinese stage has adopted many innovations from the Occident.

A. E. Z.

BIBLIOGRAPHY.—H. A. Giles, *A History of Chinese Literature*, 1901; A. E. Zucker, *The Chinese Theatre*, 1925; L. C. Arlington, *The Chinese Drama*, 1930.

CHINESE EASTERN RAILWAY, the Sino-Russian railway across northern Manchuria, and the only large Russian economic holding in China. Throughout the 19th century, Russia pushed steadily eastward across Siberia until she reached the Pacific. Soon after the middle of the century she began to turn her eyes toward Manchuria, with the possibility in mind of getting a naval base in ice-free waters. In Apr., 1895, she joined with France and Germany in compelling Japan to give up the area in South Manchuria which Japan had secured as a result of the Sino-Japanese war. In May, 1896, she signed with China a secret alliance of mutual support which also provided that Russia should have the right to build a railway directly across the northward bulge of North Manchuria. On Sept. 8, 1896, a contract was signed, for the construction of this railway, between the Chinese Government and the Russian-controlled Russo-Chinese Bank (later called the Russo-Asiatic Bank) which acted as the agent of the Russian Government. On Dec. 16, 1896, the statutes of the Chinese Eastern Railway Company, which was to build and operate the line, were signed. One part of the convention, signed Mar. 27, 1898, by which Russia secured a leasehold on part of the Liaotung Peninsula provided that a railway should be built southward from some point



COURTESY M. M. OF ART

T'ING CH'IN, CHINESE FIDDLE
Seen in orchestras of Chinese theaters

on the east-west line across North Manchuria to Talienwan (now Dairen) in the Leased Territory, this southward line to be an integral part of the line provided for in the 1896 agreements and to be subject to all the conditions of those agreements.

Construction of the Chinese Eastern Railway started in 1897 and the entire line was formally opened July 1, 1903. The southern branch ran southward from Harbin. The total length of the main lines covered by the 1896 and 1898 agreements was approximately 1,529 miles. In 1905, as a result of the RUSSO-JAPANESE WAR, 1904-5, Japan took the part of the southern branch of the Chinese Eastern Railway from Changchun southward, approximately 460 miles. The main line of the Chinese Eastern Railway in Mar. 1932 was approximately 1,070 miles; branches to coal mines and nearby cities brought the total mileage up to approximately 1,400 miles. The line connects with the Trans-Siberian Railway at each end.

The original agreements provided that the Chinese Eastern Railway Company should be a joint Sino-Russian concern, with a board of directors of nine. The president of the company was to be named by the Chinese Government. The general manager, by agreement, was to be a Russian nominated by the Russian Government. China was to invest Taels 5,000,000 (about U.S. \$3,750,000) in the stock of the company; the balance of the costs of construction and operation was to be supplied by Russia. Only Russians and Chinese might own stock. At the expiration of 36 years from the date of opening, China might buy the line by paying the original costs plus any accumulated debts less any accumulated profits. At the end of 80 years, the line was to revert to China without charge. The railway company was given the right of civil administration in the railway zone, but China assumed the responsibility of furnishing any military protection which might be necessary. The company also secured the right to engage in mining, lumbering, and similar activities in areas near the railway.

From the beginning, the actual control of the railway and the company was exercised almost exclusively by the Russians. After the Soviet Revolution in Russia (1917) the Russian Government for a time lost all connection with the railway and the management was in the hands of the Russian manager who had been in charge before the Revolution. During the period of the inter-Allied military expedition into Siberia (1918-19) the railway was in charge of an inter-Allied board, headed by an American. In 1924 new Sino-Russian agreements were signed which brought the Soviet Government in as the Russian partner in the enterprise and, with minor modifications, re-established the form of control provided under the original agreements. In 1929 the local Chinese military chief at Harbin made a sudden move in an attempt to oust the Russians from control of the line and secure complete control for the Chinese. The Russians met this challenge with a show of force and, after a period of tension during which war threatened, the conditions

preceding the Chinese move were restored in the management of the railway, but negotiations were opened between China and Russia for the readjustment of the railway management. The Russians indicated their willingness to sell their interests in the line to the Chinese without waiting until the end of the 36-year period, but differences arose over the amount to be paid. The initial costs and the heavy operating losses for many years, excessively high because of mismanagement and graft, make a total—which under the terms of the original agreement China should pay—far greater than the present value of the line. The costs and losses amounted, roughly, to about \$400,000,000. In recent years the railway has shown a small profit.

BIBLIOGRAPHY.—J. V. A. MacMurray, *Treaties and Agreements with and Concerning China*, 2 vols., 1921; *China Year Book*, 1925 and subsequent years; official reports of the Chinese Eastern Railway Co.; W. W. Willoughby, *Foreign Rights and Interests in China*, 2 vols., 2nd ed., 1927; J. B. Condliffe, editor, *Problems of the Pacific*, 1930.

CHINESE EXCLUSION ACTS, bills which have limited or barred Chinese immigration into the United States. Emigration of Chinese into the United States, insignificant before 1849, was accelerated by the demand for menial labor in California during the gold rush era, and afterward by demand for labor on the Central Pacific and other railroads. Between 1850 and 1880, 300,000 Chinese entered the country, a male emigration, transient by intention. They provided docile, patient labor, and were not interested in unionism. Opposition to their presence developed among American workmen (see KEARNEYISM), fear of lowered standards of labor and living coordinating with rumors of secret societies with "hatchet men" and other traits of clannishness and crime among the Chinese.

In the 1850's the legislature of California began a series of discriminatory statutes, to keep Chinamen out of the mines and out of the public schools. The Supreme Court of California excluded Chinese testimony in all cases against whites until 1872. The BURLINGAME TREATY, 1868, expressed the liberal opinion of the East before the question of Chinese exclusion had become a vital issue in California politics. Inundated with petitions from California and Nevada, Congress took action, in 1876 passing a bill limiting the number of Chinese which one ship might bring into the United States to 15. President Hayes vetoed the measure as a violation of the Burlingame Treaty, but despatched a commission of three, including James B. Angell, to China as ministers extraordinary to modify the Burlingame Treaty. In Nov. 1880 they secured permission for the United States to "regulate, limit, or suspend" the coming of Chinese laborers. Congress in 1882 took advantage of this concession to suspend the entry of Chinese labor for 20 years; President Arthur vetoed the measure as an excessive suspension. Congress framed a second bill reducing the time of suspension to 10 years, and forbidding State and Federal courts to confer citizenship on Chinese. Arthur signed the measure, which became

effective Aug. 5, 1882. The Scott Act of 1888 deprived Chinese laborers who visited their native country from the privilege of returning to the United States. The Geary Act of 1892 extended the suspension for another 10 years, but abrogated the Scott Act in the case of Chinese owning property valued at \$1,000 or over, or who had close family connections in the United States. The Act of Apr. 29, 1902 continued in force all laws against Chinese immigration and made them perpetual in duration.

BIBLIOGRAPHY.—A. F. Whyte, *China and Foreign Powers*, 1927; R. L. Garis, *Immigration Restriction*, 1927; R. D. McKenzie, *Oriental Exclusion*, 1928.

CHINESE-JAPANESE WAR. See SINO-JAPANESE WAR.

CHINESE LANGUAGE, chief member of the Sino-Thai group of the SINO-TIBETAN linguistic family, and the vehicle of an important and voluminous literature dating from about 1000 B.C. Phonetically it is characterized by monosyllabism, a wealth of diphthongs and even of triphthongs, both frequent as finals, and a relative paucity of consonant-groups, two successive consonants, of which the second must always be a liquid, being allowed only at the beginning of a word, and the sole permissible consonants at the end being either one of the three oral occlusives or one of the three nasals. Another essential element here as throughout the group is the system of tones, ranging from four in the Peking dialect to nine in certain others, and serving to distinguish words otherwise identical. Each word has a tone whose inflection was perhaps originally influenced by the final, the pitch depending upon whether the initial was voiced or voiceless. The word has no INFLECTION whatever in Chinese, though a certain amount of derivation is rendered possible by tonal change (perhaps a relic of an earlier system of suffixes), and also by reduplication; but neither of these methods is much developed. Nouns and verbs are not differentiated, SYNTAX alone indicating the value of the various parts of a sentence.

The modern spoken language shows a strong tendency to form dissyllabic and trisyllabic combinations of words, attrition having rendered the language so poor in vocables that this process is necessary for intelligible speech. The Peking dialect, a form of the so-called Mandarin, is poorest in this regard, having only a little over 400 different syllables, and that of Amoy is richest, with about twice that number.

The script is ideographic in principle, though only a small minority of the characters are pure ideograms (see IDEOGRAM). Most of them are formed by combining an ideographic element with one indicating the pronunciation at the period when the characters were created. Since, however, the actual pronunciation has changed in the course of time, this "phonetic element" frequently no longer indicates the modern pronunciation. J. J. L. D.

BIBLIOGRAPHY.—M. Courant, *La langue chinoise parlée*, 1914; W. Hillier, *The Chinese Language and How to Learn It*, 6th ed., 1921; B. Karlgren, *Sound and Symbol in Chinese*,

1923; *Phylology and Ancient China*, 1926; A. Brandt, *Introduction to Literary Chinese*, 1927; A. Haenisch, *Lehrgang der Chinesischen Schriftsprache*, 1931.

CHINESE LITERATURE. Although the oldest written poems now extant were attributed to Yao (2357-2258 B.C.) and his immediate successors Shun (2258-2206 B.C.) and Yu (2206-2198 B.C.), the earliest verifiable date of Chinese literature according to sober scholars, such as Liang Chi-Chao, is 841 B.C. It was at this time, in the Chow dynasty (1122-249 B.C.), that Confucius (551-478 B.C.) collected and edited the five classics or *King*:

1. *The Book of History* or *Shu King* covers a period from the 24th to the 8th century B.C., giving glimpses of the time before Confucius. This is the most ancient record of the annals of the Chinese Empire. Two documents are protests against luxury and drunkenness.

2. *The Book of Odes* or *Shih King* is a collection of 311 poems out of 3,000 songs. These include folk-songs by the people, musical-songs by the governmental officials, and eulogies by rulers and statesmen. Each poem is classified either as *fu*, description, *hsing*, inspiration or allusion, or *pi*, metaphor. The description of poetry given in the Great Preface is famous: "Poetry is the product of thought. Thought cherished in the mind becomes earnest; exhibited in words, it becomes poetry." The odes are very valuable as an index to Chinese life at the time they were written; they deal with warfare, marriage, feasting, parties, joy rides after country fairs, and separation between wives and husbands.

3. *The Book of Changes* or *Yi King* is made up of separate chapters, written by different authors at different times. *Yi* means change in any form, the predominant characteristic of all activities and, according to Chinese thought, caused by the interaction of *yin*, female, and *yang*, male, principles in the universe. Thus "As he stood by a stream, Confucius said: Ah, that which is passing is just like this—never ceasing day or night."

4. *The Record of Rites* or *Li Chi* contains the Chinese standard of good behaviour. *Li* means order, a positive force, in contrast to negative law, or *fa*. Ideally Chinese institutions are under the encouragement of *li*. *Li* shows us what one should do toward the habit of right practice; law only warns against the wrong. Law punishes the evil that has been done; *li* prevents crime in advance. *Li* is the principle of refinement in all activities. "No matter how sincere the thought of a man may be, if it is not acted upon by *li*, he is no more than a wild man."

5. *Spring and Autumn* or *Chun Chiu* is a chronicle of the state of Lu, covering a period of 242 years (722-480 B.C.). It has linguistic importance, for it uses exact, judicious words, but it tends to a mechanical and pedantic view of literature. As to its deeper significance, Mencius says: "The world had fallen into decay and right principles had dwindled. Perverse doctrines and violent deeds had arisen. Ministers murdered their kings, sons murdered their

fathers. Confucius was afraid and wrote the *Chun Chiu*."

Before attempting the Five Classics, every student of the old China must have studied and memorized the Four Books, concerning the teachings of the Confucian sages. The Four Books or *Shu* are as follows.

1. *Confucian Analects* or *Lun Yu* consists of 20 chapters, chiefly of the views and sayings of Confucius who formulated the golden rule: "What you would not others should do unto you, do not unto them." The principle of *jen*, or human relationship, is emphasized. Confucius said: "When the father is father, the son is son, the elder brother is elder brother, the husband husband, and the wife is wife, then the family is in proper order. When all the families are in proper order, all will be right with the world." Confucius tried to establish harmonious living among all men.

2. *The Great Learning* or *Ta Hsio* is devoted to a discussion of the main principles of Confucian teaching and the seven related acts. These are to investigate things in order to extend knowledge, to be sincere in thought, to rectify the mind, to cultivate the person, to regulate the family, to order well the state, and to make tranquil and happy the world. Of these the cultivation of one's own person is emphasized. "From the emperor down to the people, all must consider this act the root of everything else."

3. *The Doctrine of the Mean* or *Chung Yong* deals with the *Tao* or the Way. "Tao is the natural way. What heaven has conferred is called nature. Accordance with this nature is called *Tao*." All religious beliefs, laws of government and social customs should move according to this natural way. Five methods are required in the study of *Chung Yong*: extensive learning, accurate inquiry, careful reflection, clear discrimination and earnest practice.

4. *The Book of Mencius* consists of seven books mostly about the sayings and doings of Mencius (372-289 B.C.) himself; although a follower of Confucius, he was more original, vigorous and independent than his master. According to Mencius human nature is good. There are four principles of goodness: benevolence, righteousness, propriety and knowledge, the seeds of which are furnished at birth. Only by asking, practicing and developing them, he can become a superior man. Besides being an important thinker, the literary style of Mencius is eloquent, beautiful and sharp.

Tao Teh King.—The *Tao Teh King* is a Taoistic book of a little over 5,000 characters, written by Lao Tze (b. 590 B.C.). Unlike Confucius, Lao Tze retired from public life to transform the immaterial or miraculous realm into the philosophy of *Tao* or Way. In this book he advocates the state of simplicity, of nature and of non-activity. He was the greatest of all the sophists. In him one sees the spirit of his age. His criticism was destructive, cynical and iconoclastic. The basis of his teaching is non-existence. "Heaven and earth and ten thousand things

come from existence, but existence comes from non-existence." By this non-existence, he meant emptiness, the beginning of all things. "Before heaven and earth it was; it contains all . . . how silent! how solitary! Alone it stands and changes not. Around it moves and suffers not. It is the mother of the universe. I know not its name. I call it *Tao*." . . . "Empty space is the utility of all things," as the utility of a wine glass depends on its emptiness, where wine is to be put, not in the form of the glass nor in the stuff of which the vessel was made. He speaks the doctrine of political *laissez-faire*. To him the best government is non-governing; the way of nature is non-action. "The more restrictions and prohibitions there are in governing a nation, the poorer grow the people; the more inventions and weapons provided for soldiers, the more troubled is the state."

Chuang Tze, who lived in the 4th century B.C., elucidated the teachings of Lao Tze, and advanced the theory of evolution, that all species are naturally evolved through variation in forms, and that each is adapted to its particular place and environment. The most beautiful prose poems of Chinese literature are written by Chuang Tze. Lieh Tze, who lived some years before Chuang Tze, is another Taoistic writer who left two valuable volumes devoted to the elucidation of this mystic philosophy.

Other Chinese Writers of Antiquity. The teachings of Mo Tze (c.500-420 B.C.) contain many precepts closely similar to those of Christianity, such as universal love, world peace and community property. His doctrines of self-sacrifice are embodied in 53 books. Mo Tze was the earliest Chinese thinker to conceive of God as a sovereign power. Yang Chu, his contemporary, taught the opposite, an ethical egoism, and the pursuit of pleasure for the self as the basis of life. *Li Sao* (Falling into Trouble) by Chu Yuan, a writer of the 3rd century B.C., is the most famous elegy of ancient times. It is in the form of a love-allegory.

During the Chin Dynasty, in 212 B.C., all the classics were burned by the order of the emperor, Shih Huang Ti, who wished to blot out the history of antiquity and thus to establish his own absolute power.

Literature of the Han Dynasty. At this time (200 B.C.-200 A.D.) classical poems were composed of four characters with every other line rhymed. There originated from music and dance, the type of prose poem called *Fu*, which was recited, not sung. It was used for satirical as well as lyrical and narrative pieces. The Han Dynasty ended in the Dark Years (200-600 A.D.), a period of civil wars, when the seven great poets wrote innumerable songs.

Tang Dynasty. This is the Romantic age of Chinese poetry. Most of the emperors were either poets or enthusiastic lovers of poetry. The Empress Wu Chao first required poetry for the literary degree necessary for officialdom. The greatest poets belong to this time (600-900 A.D.): Li Po, Tu Fu, Po Chu-yi,

Wang Wie and many others. Form was valued more than content. Their poems came to be memorized as models in the old China. Poets first became professional. Intellectuals from north and south met and discussed poetry together for the first time.

Sung Dynasty. This period, from 960-1200, is also known for its great poets, such as Su Tung-p'o and Ou Yang Hsui; its historians, such as Sau Ma Kuang, and Sung Chi; and its philosophers, among whom, Chu Hsi, first made Confucianism an orderly philosophic system.

Mongol Dynasty, a century and a half (1200-1368) important for the drama and the novel. The *San Kuo Chi* (Romance of Three Kingdoms) and the *Hung Lou Ming* (Dream of the Red Chamber) of the Manchu period, 1644-1900, are famous. The former is a historical novel, written in the 13th century. The latter, written by Tsao Heuch-Chin (1719-64) is autobiographical, being the first realistic novel of China, with more than 400 characters.

Besides the literature proper of China, there are innumerable other books on military strategy, medical sciences, mathematics, astronomy, music, and dictionaries and encyclopedias. The standard lexicon of Emperor Kang Hsi (1662-1723) is in every scholar's possession.

Recently a new literary movement arose which has been called the Chinese Literary Renaissance. It makes use of the *pai hua* or plain speech as opposed to the classical language: a very radical departure from all the literary traditions of China. It was started under Hu Shih in 1917 and has become an attempt to recapitulate and to adapt the individualistic thought of the West to China, with special reference to the pragmatism of JOHN DEWEY. See also KOREAN LITERATURE. Y. K.

BIBLIOGRAPHY.—A. Wylie, *Notes on Chinese Literature*, Shanghai, 1867; H. A. Giles, *History of Chinese Literature*, 1901; 170 *Chinese Poems*, translated by Arthur Waley, 1918; Younghill Kang, *Translations of Oriental Poetry*, 1929.

CHINESE MARITIME CUSTOMS ADMINISTRATION, the department of the Chinese government which has to do with the collection of import and export duties, the administration of harbors and lighthouses, etc. Trade by sea had developed as early as the 10th century sufficiently to call for the establishment of a maritime customs administration, with customs offices principally on the South China coast. During the Taiping Rebellion, 1850-64, when the imperial authority had been overthrown for a time at Shanghai, the foreign consuls arranged to collect the customs duties pending the re-establishment of regular Chinese administration. The amounts turned over to the central government proved to be so much greater than they had been when collections were made by the Chinese officials, that when Manchu authority was re-established arrangements were made to continue semi-foreign control of the customs administration. Before long, Robert Hart was made inspector-general, and he held the post until his death in 1911. Under his control, the cus-

toms administration became a notably efficient and honestly administered institution. The customs revenue became the principal dependable source of government income. For this reason it was pledged as security for government loans and indemnities. Theoretically, the inspector-general was subordinate to the Chinese minister of finance, but in practice, particularly after foreign obligations had been secured on the customs revenue, he became independent. After Hart's death the Chinese began a campaign to regain effective control of the customs administration. They finally succeeded, after the establishment of the Nationalist government and after China at the beginning of 1929 secured tariff autonomy. The inspector-general of customs continued to be a foreigner—a Briton—but from 1929 on he has been definitely under, rather than in effect independent of, the minister of finance.

CHINESE PHILOSOPHY has been designated by Creel as Sinism. Chief among its concepts is the idea of order. Nature is throughout regarded as harmonious. When things are working in harmony good is the inevitable result. Nature thus is not only good, but man being a part of nature is also fundamentally good. This conception of man as essentially good by nature may be set in contrast with Christian theology and its doctrine of original sin. The Chinese were the ancient Rousseaus. Central to their natural philosophy are the ideas of heaven and earth. These are known as the *Yang* and the *Yin* respectively. The *Yin-Yang* principle is also represented by the female and male elements, the earth standing for the female principle and heaven for the male. The five elements are wood, fire, metal, water and earth. The number five is a favorite one for the Chinese, there being not only five elements but five sounds, five colors, five odors, five virtues, etc.

Confucius (Kung Fu Tse, 551-479 B.C.), was not so much an originator as an organizer of Chinese thought. With him Sinism is made conscious of itself. Although his teachings were largely of an ethical and political nature, they were grounded in the nature of things. The *Tao*, or order, both in nature and society must be preserved. Rules and regulations become the necessary means to these ends. From this it is but one step to the worship of custom and the reverence for ancestors. The ruler's conduct was responsible for the welfare of the state. Mencius (Meng Tse, 372-289 B.C.) supplemented the work of Confucius. Hsün Tse (320-235 B.C.), although classed as a Confucian, repudiated the fundamental principles of Sinism. By robbing Confucianism of its metaphysical basis he gave it a pragmatic bent that virtually denied it. He believed that human nature is bad and hence became conservative along educational lines. Opposed to Confucius was his contemporary Lao Tse (570-490 B.C.). Although he accepted the doctrine of the *Tao*, he drew from it the conclusion that man should not interfere with the natural and social order. The wise man is he who withdraws from life and contemplates the *Tao*. Yang Chu, start-

ing with Lao Tse's premises, arrives at opposite conclusions and becomes a Hedonist, while Chuang Tse does for Laoism what Mencius did for Confucianism. Mo Tse (470-391 B.C.) makes Confucius's negative teaching of the Golden Rule more positive by developing the idea of altruism and the principle of universality.

BIBLIOGRAPHY.—Hu Shih, *History of Chinese Philosophy*; H. G. Creel, *Sinism, the Development of the Chinese World View*, 1929; W. S. A. Pott, *Chinese Political Philosophy*, 1925.

CHINKIANG, a treaty port and commercial city of central China, situated at the meeting point of the Yangtze River and the Grand Canal in the province of Kiangsu. Its name means "Guard the River," and from its position on the brown waters of the Yangtze, Chinkiang stands in low hill and island scenery. The city is on the Shanghai-Nanking Railway, about 160 mi. from Shanghai, and 40 mi. from Nanking. Its chief exports are bean cake, sesamun seeds and peanuts. By means of Yangtze steamers Chinkiang ships wheat, rice, and cotton raised on the Kiangpoh plains north of the river. But of late years her export trade has decreased until the port has become chiefly a distributing point for imports. Trade was opened by the Treaty of Tientsin, 1858. Pop. 1928, est. 146,700.

CHINOOK, a tribe and important North American Indian linguistic family. The tribes speaking Chinook lived on the Columbia River from the Dalles to the mouth of the river and on the lower Willamette in Oregon. The coast to the north as far as Shoalwater Bay and to the south to Tillamook was also Chinook territory. There were two linguistic divisions: lower Chinook, which included the Chinook proper and the Clatsop, and the upper Chinook, which included a group of tribes differing somewhat dialectically. The present-day Chinook live on the Warm Springs and Grande Ronde reservations in Oregon, and on the Yakima reservation in Washington. Formerly the Chinook lived in semi-permanent villages. Their customary food supply consisted in the main of salmon, roots and berries. They were excellent canoeists and in their dugout canoes made long trading journeys up the Columbia River. The Chinookan tribes were taller than the other coast tribes, with wider faces and narrower and higher noses. They were distinguished also by the custom of artificially deforming the head by means of fronto-occipital pressure; a normally shaped head was allowed only for their slaves. The Chinook proper occupied the territory on the north side of the Columbia River, a distance of fifteen miles from the mouth of Gray's Bay and northward along the coast as far as the north part of Shoalwater Bay, where their territory adjoined that of the Chehalis. Their language formed the basis for the Chinook jargon, the trade jargon on the coast from California to Alaska.

CHINOOK, a warm, dry wind generally blowing from southwest to northeast across and over the Rocky Mountains in the northwestern part of the U. S. and Canada. It derives its name from the Chinook Indians, who formerly inhabited that part of the globe.

The chinook is cold and dry in the beginning, but during its descent into the valley the increase in pressure causes it to heat up, thus further increasing its dryness, i.e. its ability to absorb moisture. When it arrives on the plains it is usually very dry and warm, and able to melt and evaporate snow in great quantities and very rapidly. In winter it thus alleviates the severe climate of the northwest, but may cause floods along its course, even though it blows only a few days. In summer it may dry up and scorch crops and vegetation. An analogous wind which blows in Switzerland, originating in Italy and crossing the Alps as a dry and warm wind, is called FOHN.

CHINOOK JARGON, a medium of communication, commercial and other, employed along the Pacific coast from California to Alaska. It consists of a vocabulary based on Chinook, an AMERICAN INDIAN language spoken by a number of tribes on both banks of the Columbia River from its mouth to the Grand Dallas, mixed with words of other American Indian dialects, French and English, and with grammatical distinctions entirely leveled out.

CHINQUAPIN, the name given to several trees and shrubs closely related to the chestnut. The common chinquapin (*Castanea pumila*), usually a small tree but sometimes shrubby, and the alder-leaved chinquapin (*C. alnifolia*), generally a shrub, occur in the southern United States. Both differ from the true chestnut in having only one nut in a bur. The so-



FROM JEPSON MAN. PL. PLANTS CALIF. COPYRIGHT
GIANT CHINQUAPIN OR GOLDEN-LEAVED
CHESTNUT
Flowering branchlet

called golden-leaved chestnut (*Castanopsis chrysophylla*), of the Pacific coast, is also called chinquapin.

CHIOS, an island in the Aegean Sea, about 4 mi. from the coast of Asia Minor. It is about 30 mi. long, 8 to 15 mi. in breadth and has an area of 320 sq. mi. Its surface is diversified, the northern coast rising steeply into limestone formations and the southern stretching into an open country of great fertility. Oranges, olives, figs, lemons and mastic, a liquor of excellent quality, are the main products. The history of Chios has been tragic. In 1822 some of its inhabitants rose in revolt against the Turks and the entire population comprising some 100,000

souls was massacred or sold into slavery and most of the plantations destroyed. In 1881 a terrific earthquake destroyed half the villages and killed 6,000 persons. During the Balkan War in 1912 Chios was occupied by Greece, which later as a result obtained its possession. The city of Castro, or Chios, on the east coast, is the capital. Pop. 1928, 75,680.

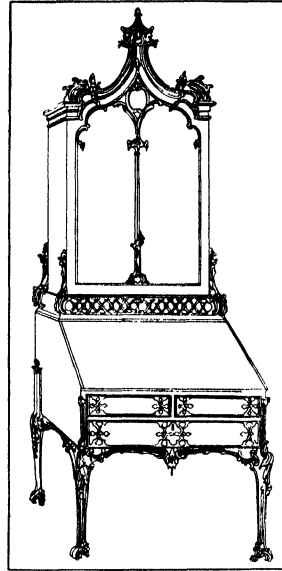
CHIPEWYAN, an American Indian tribe speaking a dialect of the northern Athapaskan linguistic stock. Their habitat was in the vicinity of Churchill River, Great Slave and Athabaska lakes. They now live on reservations in Alberta. Culturally they are rather typical of the Mackenzie culture area. They hunt and trap in winter, using dogs and sleds, and use tents for shelter. In summer they frequent the lakes where fish and water-fowl are plentiful. For water transportation they use the birchbark canoe. Nowadays they make few of their own utensils or articles of clothing, manufacturing only birchbark canoes, snowshoes and moccasins. They have been converted to Catholicism.

CHIPMUNK, a striped GROUND-SQUIRREL of the genera *Tamias* and *Eutamias*. Our eastern example (*Tamias striatus*) is the familiar reddish little creature marked with two black and a white sidestripe; he belongs to the old stone walls, rocky, bushy hillsides and brush heaps. Western chipmunks (*Eutamias*) are the smaller, of the many varieties and have more and narrower stripes. All chipmunks excavate and live in fairly permanent burrows connected with underground runways. They hibernate more or less completely, yet lay up winter stores of nuts and dried berries.

CHIPPENDALE, THOMAS (c. 1718-79), English cabinet-maker and furniture designer, was baptized June 5, 1718, at Otley, Yorkshire. Little is known of his personal life other than that he married twice and was the father of eleven children. In his early twenties he moved to London and established a shop in St. Martin's Lane, his headquarters until his death. *The Gentleman and Cabinet-Maker's Director*, containing 160 engraved plates of Chippendale furniture, was first published in 1754; it went through two subsequent editions and established Chippendale's reputation. French, Chinese and Gothic influences are noticeable in Chippendale furniture; sometimes all three are skillfully combined in one piece. He used dark mahogany almost exclusively. The designer's fame rests chiefly on his chairs, but he is also noted for his settees, small tables, escritoirs, bookcases and long clock cases. Chippendale was buried Nov. 13, 1779, at the church of St. Martin-in-the-Fields, London. A son, Thomas Chippendale II (d. 1823?), succeeded to the great cabinet-maker's business.

CHIPPEWA, BATTLE OF, July 5, 1814, an engagement of the WAR of 1812 which resulted in an American victory. Between the Niagara River and its tributary, Chippewa Creek, 1,700 British troops under Gen. Riall advanced against 1,300 Americans under the active command of Generals Scott and

Porter. The British line maneuvered unskillfully, each regiment exposing its flanks. Scott's brigade advanced, halting and firing at alternate steps, until within 80 paces of the enemy. Then a running charge put the British to rout, unchecked until they were behind breastworks on the opposite side of Chippewa Creek. The American loss in the morning's skirmishing and the evening battle was 328; the British loss was 236 killed, and 368 wounded or miss-



COURTESY M. W. OF ART
A DESK AND BOOKCASE FROM AN ORIGINAL DRAWING BY THOMAS CHIPPENDALE

ing. The victory gave impetus to enlistments in the American army, and persuaded most of the Indian allies of the British to desert.

CHIPPEWA FALLS, a city in northwestern Wisconsin, the county seat of Chippewa Co., situated on the Chippewa River, 187 mi. south of Duluth. Three railroads serve the city. There is also an airport 2 mi. south. This region produces potatoes, peas and tobacco. In the city woollens, shoes and various other articles are manufactured. The site of Chippewa Falls was an early hunting ground of the Ojibwa Indians. The city was settled by lumbermen in 1837 and chartered in 1869. Pop. 1920, 9,130; 1930, 9,539.

CHIRATA (*Swertia chirata*), a perennial plant of the gentian family native to northern India, called also chiretta. The dried stems yield a bitter tonic with properties very similar to those of the gentian.

CHIRICAHUA, a warlike division of the Apache Indians, speaking an Athapaskan dialect and resembling both physically and culturally the other

groups of Arizona Apache. They were nomads, camping on the highlands during the winter and in summer close to the river banks, usually in rude, brush-covered round houses. They lived mainly on the vegetable products of their environment and engaged in agriculture, growing maize and melons, and making baskets. Authorities differ as to their social system, but there appears to have been a band or clan organization. They now live on the San Carlos Apache Reservation in Arizona.

CHIRICAHUA, a national monument situated in southeastern Arizona administered by the Department of Agriculture. A tract of 4,480 acres was set aside Apr. 18, 1924 to preserve a region of peculiar natural rock formations containing pillars, balanced rocks, fantastic figures of animals, representations of human faces and forms and other strange shapes. A natural road about 20 mi. in length leads in to the monument from Rodeo, which is on a U.S. Interstate Highway connecting Lordsburg, N.M. and Douglas, Ariz., both on the Southern Pacific Railroad.

CHIROL, SIR VALENTINE (1852-), English diplomat and political writer, was born on May 23, 1852. He was educated in France and Germany, and became a clerk in the foreign office in 1872-76. Later he traveled through the British colonies and the Far East. He became director of the foreign department of the London *Times* in 1899, and served as the *Times* correspondent in Berlin. He has published *The Far Eastern Question*, *Indian Unrest*, *Fifty Years in a Changing World* and other volumes treating English colonial problems.

CHIROMANCY, another name for **PALMISTRY**, or reading character from the lines and features of the hand.

CHIRON. See **CHEIRON**.

CHIROPRACTIC, a method proposed for the treatment of all disease, based upon the idea that all disease arises from pressure of the bones of the spine upon the nerves that come out of the orifices between the bones. The theory was originally propounded by Andrew Still as the basis of osteopathy. Later D. D. Palmer, a magnetic healer of Davenport, Iowa, developed the method as chiropractic after osteopathy has expanded its doctrines to include other conceptions. The method has been promoted primarily by B. J. Palmer, son of the founder, now in control of the Palmer School of Chiropractic. The practice of chiropractic is controlled by medical practice legislation acts which vary in different states. Some states practically exclude chiropractors by special legislation governing medical licensure. The number of chiropractors said to be practicing in the United States is approximately fifteen thousand. The cult is little known abroad and practically all its practitioners reside in America. M. F.

CHIROPTERA, the scientific name for the order of mammals popularly called **BATS**. They are the only members of their class which have wings, and they are able to fly as well as many birds. A bat's wing is membranous. The greatly elongated fingers

of the animal's hand serve as ribs on which to extend it, much as an umbrella is held out by its metal ribs. The thumb is free, and is used by the creature in crawling. Except in bright light the old saying "as blind as a bat" is meaningless, for a bat's vision is exceedingly keen in dull light. Its sense of touch is probably more delicate than that of any other animal.

CHIRU, a wary and graceful antelope (*Pantholops hodgsoni*) inhabiting the high plateau of Tibet. The chiru stands 32 in. at the shoulder. The long, straight horns of the buck are black, elegantly tapered, and strongly ringed in front. The thick, fawn-colored coat is woolly beneath, as befits the climate. The nose in the male is peculiarly puffy, with enlarged nostrils, a feature regarded as an adaptation to the rarefied atmosphere at elevations of 13,000 to 18,000 ft. It moves in small herds.

CHISEL, a hand tool for cutting wood or metal, comprising essentially a forged steel bar flattened and sharpened at one end and tempered to bring its cutting edge to the desired hardness. Wood chisels are of many shapes including flat, half-round and V-shaped types. They are manipulated with the hand or with the aid of a hammer or mallet. Chisels for metal are more blunt in shape and of harder temper. Hot chisels, used by blacksmiths for cutting hot metal, are shaped somewhat like an Ax, having a wooden handle. Cold chisels, used in shaping cold metal, are all steel. See also **GUGGES**.

CHISHOLM, a city in northern Minnesota, the county seat of St. Louis Co., situated 75 mi. northwest of Duluth. Chisholm is an iron mining town on the Mesabi range. Bus lines and two railroads serve the city. The region produces lumber and farm crops. One of the deepest open pit iron mines in the world is located at Chisholm. Founded in 1900, the city was incorporated in 1901. Pop. 1920, 9,039; 1930, 8,308.

CHISINAU, Kishinev, capital of Bessarabia in Rumania and of the district of Lapusna, on the Byk River, a tributary of the Dniester. The new city is laid out with streets intersecting at right angles, above which tower the gleaming onion-shaped turrets of about 20 churches. It is the seat of the Greek-Orthodox metropolitan of Bessarabia, of a Roman Catholic bishop and of a prefect, and has a Protestant church and school, a mosque, 31 synagogues, theological seminaries, schools, libraries and theaters. The brisk trade is almost entirely in the hands of the Jews. Industry is largely agricultural. The inhabitants are Rumanians, Jews, Ukrainians, Russians, Germans and others. Pop. 1930, 117,016.

CHISLEHURST, Kent, is a suburb of London where many of its population are employed. It is located on the top of North Downs about 300 ft. above sea level and because of its better climate and air many London workers make it their residence. Napoleon III and the Empress Eugenie lived in Chislehurst during his exile and after his death in 1783 she remained for seven years. Pop. 1931, 9,876.

CHISWICK, a suburb of London, England, situated on the Thames about 7 mi. to the west of the

city. Chiswick House was formerly a seat of the Dukes of Devonshire, and in 1928 was acquired by the District Council to be made an art gallery. In the yard of the parish church is the tomb of WILLIAM HOGARTH, the famous artist. Pop. Chiswick and BRENTFORD 1921, 57,970; 1931, 62,617.

CHITA, a city in the southeastern part of the Eastern Siberian Region of the R.S.F.S.R., situated near the southern Vablonoi Mountains. On the Trans-Siberian Railway, Chita is a shipping point for furs, ores and lumber. Among the several minor industries which contribute to the city's growing prosperity are iron founding, tanning and the manufacture of chemicals. Founded in 1653, the city's growth began in 1825, when exiled Decabrists, participants in the plot of Dec. 1825, settled here. The Kunetzoff Geographical Museum is the most important building. Before the 1917 Revolution Chita was the capital of the Trans-Baikalian district. Pop. 1926, 61,526.

CHITON, the typical genus of the family *Chitonidae* of the marine mollusk class *Amphineura*. Chitons are widely distributed, and there are many different species. They range in size from species little more than half an inch long to giants over eight inches long. In the United States only small forms live on the Atlantic coast north of Florida. Florida has larger species, and very large ones are found along the shores of California.

The chitons are among the most primitive of mollusks. They have coat-of-mail shells, made of eight overlapping plates, which articulate in such a way that the animals can roll up in a ball to protect the unarmored lower surface. They cling habitually to the rocks by means of a powerful foot. So strong is their hold, and so closely does the shell fit against the rock, that it is sometimes almost impossible to pry them loose with a knife.

CHIVALRY, as a body of principles and a way of life applicable to knights, was of slow growth in western Europe, but was well-formed by the 13th century. While chivalry was chiefly social in nature it was to some extent political, for in an age when nationalism was unknown and even the concept of a central national dynasty was weak, the stressing of the obligation of a man towards his lord helped link together an otherwise disorganized society.

The social obligations of chivalry were various: those of a man towards himself, to preserve his honor and self-respect; towards his dependents, to give them the care which that dependency entailed; and finally towards the Church. The code of chivalry towards women was curious, for on the one hand it officially took over the Christian doctrines of chastity, while on the other it became involved in a code of romantic love.

The origin of chivalry is almost impossible to disentangle from the maze of Germanic, Celtic, Christian, Roman and Arabic influences which can be found in it. The name itself implies that it grew up as the code of a mounted soldiery, i.e., the wealth-

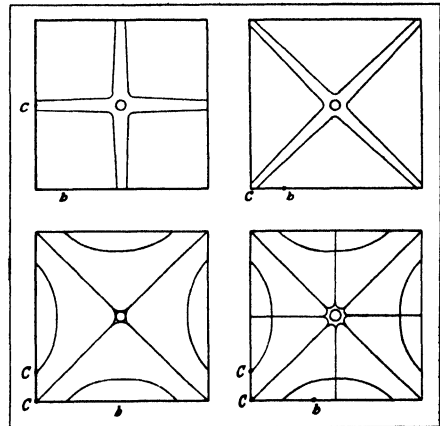
ier soldiers, conscious of their position. On the other hand, the heraldic names were mostly of an Arabic source, and the contact of Europe with the more polished Saracenic society in Spain and the Levant must have exerted a powerful influence on the development of polite society in Europe.

CHIVE (*Allium Schænoprasum*), a hardy perennial of the lily family, found wild in northern regions. It is similar to the onion, to which it is closely related, but has small clustered bulbs. The chive is cultivated sparingly as a vegetable, the young hollow leaves being used in soups and salads. It is also grown as a border plant for its handsome rose-purple flowers.

CHIVERS, THOMAS HOLLEY (1809-58), American poet, was born near Washington, Ga., Oct. 18, 1809. He studied medicine, but practiced only one year. Poe said of him that he was "one of the best and one of the worst poets in America." He and Poe, though friends, made mutual accusations of plagiarism. Chivers was a mystic, a believer in visions and an experimenter in verse forms. Among his writings are *Nacoochee*, *The Lost Pleiad* and *Other Poems and Via Coeli*. He died at Decatur, Ga., Dec. 18, 1858.

CHIWERE, a name applied to a group of Siouan-speaking tribes, including the Oto, Iowa and Missouri.

CHLADNI FIGURES. If a thin plate of metal or glass be clamped at some point and its edge stroked with a violin bow, it will vibrate in a complicated manner. Fine sand sprinkled on the surface of the plate will be thrown from the areas of the



FOUR CHLADNI FIGURES ON A SQUARE PLATE CLAMPED AT CENTER

The bowing point is marked by b. Finger is applied lightly at C

most violent vibrations and will collect along lines where the vibration is the least. This method of studying a vibrating plate was first used by Chladni (1756-1827), the sand figures so obtained being named after him.

The accompanying illustration shows four typical figures for a square plate clamped at its center. B marks the point of bowing, and C the point at which the finger is placed. A very large number of figures are possible. The method has been used for the study of vibrations much too complicated for mathematical treatment, as, e.g., the vibration of a piano sounding board. P. E. S.

CHLORAL, a colorless mobile liquid (CCl_3CHO), with a pungent smell and harsh taste. Its pungent vapor is irritating to the eyes. It is prepared by the action of chlorine on ethyl alcohol. When mixed with an equal quantity of water, it produces **CHLORAL HYDRATE**.

CHLORAL HYDRATE, colorless, transparent crystalline substance, $\text{CCl}_3\text{CH}(\text{OH})_2$, with an aromatic, penetrating odor; commonly known as "chloral"; soluble in water and alcohol. Chloral hydrate in small doses depresses the central nervous system, inducing a condition resembling normal sleep. It is, therefore, used for the relief of insomnia and nervousness and for the control of convulsions or spasmodic conditions. It is a habit forming drug and as such may result in chronic poisoning; larger dose may be fatal.

CHLORAMINE, white crystalline powder with a slight odor of chlorine, soluble in water. Also chloramine-T, or sodium *para*-toluenesulpho-chloramide— $\text{CH}_3\text{C}_6\text{H}_4\text{SO}_2\text{NaCl}\cdot 3\text{H}_2\text{O}$. The actions of chloramine are essentially similar to those of surgical solution of **CHLORINATED SODA**, except that it has the advantages of stability and convenience of preparation.

CHLORATES, chemical compounds characterized by the radical ClO_3 . Chlorates form when hypochlorites are heated in slightly acid solution: $3\text{KOCI} \rightarrow 2\text{KCl} + \text{KClO}_3$. They are chiefly manufactured by electrolysis of hot salt solution in a cell containing no diaphragm: $\text{NaCl} + 3\text{H}_2\text{O} \rightarrow \text{NaClO}_3 + 3\text{H}_2$. The NaClO_3 is won by crystallization. Other metallic salts are obtained by double decomposition with NaClO_3 . Chloric acid (HClO_3) is formed from BaClO_3 and H_2SO_4 .

Chlorates are oxidizing agents; KClO_3 is an ingredient in explosives and matches; chlorates are used in mordanting dyes, leather tanning; as a weed killer in agriculture, in recovery of bromine from brines; in medicine, disinfectants and photography. R. B. M.

CHLORIDES, binary compounds of chlorine. Sodium chloride (NaCl), common salt, is one of the most abundant substances in the earth's crust. Sea water contains 3.5% solids of which 55% is the element chlorine. Vast deposits of NaCl occur as halite and rock salt near the earth's surface. In lesser quantities occur chlorides of potassium, calcium and magnesium, and many other metals.

Salt is used in the manufacture of many sodium compounds by double decomposition, e.g., NaHCO (see **SODA**), NaHSO_4 (salt cake). It yields metallic sodium or caustic soda and chlorine on electrolysis.

Brines of sodium, calcium and magnesium chlorides are used in refrigeration.

Chlorine reacts with most other elements to form chlorides, some of the most important being aluminum chloride, used in petroleum cracking and organic synthesis; zinc chloride, used in water-proofing and fire-proofing wood and paper; sulphur chloride and phosphorus chloride, chlorinating agents; carbon tetrachloride and chloroform, solvents, magnesium oxychloride stucco; mercuric and mercurous chlorides in medicine. R. B. M.

CHLORINATED LIME, a white granulated powder of variable composition resulting from action of chlorine or calcium hydroxide, having a chlorine-like odor and repulsive taste. It is used as a disinfectant and as a source of chlorine for treating contaminated drinking waters. In industries it is particularly useful as a bleaching agent, and hence is known by the name bleaching powder.

CHLORINATED SODA, SURGICAL SOLUTION OF, an aqueous solution of sodium hypochlorite carefully adjusted to contain 0.43 to 0.48 of available chlorine and made free from caustic alkali. This solution was developed during the World War by Drs. Carrel and Dakin for the disinfection of wounds, and was then known as Carrel-Dakin Solution, or modified Dakin Solution. It was applied by passing a continuous stream of the solution (irrigating) over wounds, to prevent progressive infection and to remove some of the necrotic tissue. In the war, this procedure was generally credited with saving many limbs from amputation. It may also be used as a spray, gargle, or wash. P. N. L.

CHLORINATION, process of treating with chlorine as a reduction agent.

Water: City drinking water is commonly treated with 1-6 parts per million chlorine gas to destroy bacteria. Swimming pool water and treated sewage requires 5-50 parts per million.

Garbage Incinerator Gas: Odors are removed by chlorination.

Paper Mill Effluent: Organic matter is destroyed by chlorination to prevent stream pollution.

Alkalies: Hypochlorite bleaches, used extensively in paper pulp and textile manufacture, are made by chlorination of lime, soda (see **HYPOCHLORITES**; **CHLORATES**).

Ores: Certain metals may be separated from their ores by conversion to volatile or water soluble chlorides. The ore is usually chlorinated hot with chlorine gas or sulphur dichloride. Products: FeCl_3 , CrCl_3 , SbCl_3 , PCl_3 . See **ORE TREATMENT**.

Carbon Bisulphide: Product, carbon tetrachloride (CCl_4).

Carbon Monoxide: Product, phosgene (COCl_2).

Sulphur: To produce sulphur chloride, sulphuryl chloride, etc.

Brine: To liberate bromine and iodine therein.

Organic Compounds: Compounds of higher molecular weight, melting point, and less inflammability are prepared by chlorination; for example, tetrachlorethane, ($\text{C}_2\text{H}_2\text{Cl}_4$), by chlorinating acetylene; chlorobenzene ($\text{C}_6\text{H}_5\text{Cl}$), by chlorinating benzene. Prod-

ucts: solvents, waxes, dye intermediates, synthetic organic compounds, war gases (see MUSTARD Gas).

Other Applications: Chemical warfare; medicinally, to relieve influenza, whooping cough. R. B. M.

BIBLIOGRAPHY.—*Water Works Practice*, American Water Works Association; D. M. Lidel, *Handbook of Non-Ferrous Metallurgy*.

CHLORINE, a heavy greenish-yellow gaseous element (Symbol, Cl) with the following constants: gas density 2.49 (air = 1); liquid specific gravity 1.56 at boiling point; boiling point -33.6°C , freezing point -101.6°C , atomic weight 35.46, atomic number 17. It is soluble in water.

Chlorine is secured in gaseous form from the electrolysis of common salt brine. The brine is run into electrolytic cells, subjected to a direct electrical current, the chlorine being set free at the anode, with hydrogen and caustic potash forming at the cathode. After cooling and thoroughly drying in earthenware or similar equipment, the chlorine gas is liquefied to an orange-colored liquid by compressing and cooling, usually in the presence of strong sulphuric acid. Iron or steel apparatus is used. Liquid chlorine is stored in insulated tanks and shipped in 100 or 150 lb. cylinders, and single or multiple unit tank cars. The single unit cars carry 16 and 30 tons net weight respectively, and the multiple unit cars carry 15 containers, each holding one ton net weight of chlorine.

Chlorine has many and varied uses, the largest being the BLEACHING of paper pulp. Considerable quantities are also used for the sterilization of municipal water supplies and the treatment of sewage. (See CHLORINATION.) Minor quantities are used in the manufacture of bleaching powder, HYDROCHLORIC Acid, textile bleaching liquor, and military poison gas. Metallurgical uses include the recovery of gold and silver from their ores, the extraction of copper, lead and zinc from mixed ores, separation of vanadium and tungsten from their ores. It is also used for de-tinning scrap tinned iron, de-zincing scrap galvanized iron, which results in the formation of tin and zinc chlorides respectively, free from iron if anhydrous chlorine is used. Chlorination of oils and waxes, chlorination of rubber, the manufacture of rubber substitutes and intermediates and organic syntheses are uses of chlorine worthy of mention. See also CHLORIDES; CHLORINATION.

The chief medical and pharmaceutical applications of chlorine, however, are in the form of CHLORAMINE, surgical solution of CHLORINATED SODA or CHLORINATED LIME (bleaching powder). A. H. H.

CHLORITE, the designation of a family of rock-forming silicates of closely related properties. They are green and resemble Mica, to which they are related. The chlorites, however, are not elastic, as are plates of mica, although they are flexible and cleave with the same facility into thin sheets or lamellae. Chemically they are hydrous silicates of iron, magnesium and aluminium, differing from the true micas in the absence of calcium and the alkalis. Like mica they crystallize in the MONOCLINIC SYSTEM.

Chlorites result from the alteration of such minerals as PYROXENE, AMPHIBOLE, BIOTITE and GARNET, and are found in SCHISTS and SERPENTINE and in some ORE DEPOSITS. See also METAMORPHISM.

CHLOROFORM, or trichloromethane, a heavy, clear, colorless, sweetish-smelling liquid, CHCl_3 , which boils at 61.2°C . It is made commercially by treating ethyl alcohol or acetone with calcium hypochlorite (bleaching powder). It is valuable as a solvent for organic compounds and has been extensively used as an anesthetic.

Chloroform is one of the oldest general ANESTHETICS. Its action is similar to that of ether, but it is considered to be less desirable. (In case an operation is performed near an open flame, it is better to use chloroform than the inflammable ether.) Chloroform is also used in liniments, and small doses are taken by mouth for its preventive and antiseptic effect in gastric fermentation and colic.

CHLOROPICRIN, known also as trichloronitromethane, CCl_3NO_2 , is formed by the simultaneous action of nitric acid and chlorine on various organic compounds. It is a powerful lacrimating agent and as such was used in large quantities during the World War.

CHLOROSIS, a condition early called "green sickness," because it was thought that the pallor caused by this form of ANEMIA assumed a greenish color. Chlorosis is not a disease, but is the medical name of an abnormal condition of the blood characterized by anemia. If there is a diminution in the number of red blood corpuscles (see BLOOD) with a diminution in the amount of hemoglobin in these corpuscles and the percentage of loss of hemoglobin is much greater than the percentage of loss of red corpuscles, the condition of *chlorosis* is present.

Chlorosis was once a frequent condition, occurring only in young girls at about the age of puberty, namely, from about fourteen years to the age of eighteen or twenty. At present this condition is rare, probably because the girl's diet now contains all of the elements needed for nutrition, including the necessary vitamins. In the absence of a sufficient amount of vitamins the metabolism of the body cannot well take place and denutrition occurs. These vitamins and various iron-containing vegetables are necessary for the normal health of what are termed the ENDOCRINE GLANDS.

This peculiar condition of chlorosis is associated with general weakness, lassitude, loss of appetite and frequently craving for some particular type of food, or even a craving for earthy things, as chalk or something of that type, or for sour foods. There is more or less constipation, more or less indigestion, more or less mental disturbance in the way of indifference, dislike to study, desire to be alone, often disagreeable temper, pallor, anemia and shortness of breath on exertion. This shortness of breath is due to the diminished amount of hemoglobin and the consequent impossibility of a normal exchange in the blood in the lungs from carbon dioxide to oxygen. With this

condition there is likely to be cold hands and feet, sometimes a wet, clammy condition of the skin especially of the hands, and poor circulation. Girls suffering from this condition mature late, that is, there is a delayed development or absence of menstruation.

With chlorosis there is invariably abnormal function of the thyroid gland and abnormal ovarian function. The thyroid gland as well as the pituitary gland, an endocrine gland in the brain, are closely associated with normal activity of the ovaries and with normal menstruation. If these glands do not properly function, menstruation and its periodicity are abnormal.

Whatever correction is made in the surroundings, hygiene, food, life, etc., of the chlorotic girl, she must also generally receive medicinal iron. It makes little difference which form of iron is taken, but while the condition may be cured by other treatments, notably by small doses of thyroid gland extracts perhaps helped by ovarian extracts, improvement will be more rapid and more permanent if iron is administered. Just where the metabolic mistake occurs in the production of hemoglobin, whether in the bone marrow or in the liver or in some part of the digestive system, has not been determined, but some chemical reaction seems to prevent the iron in the food from reaching the organs that need it for the production of hemoglobin. Fresh air and sunlight are essential to the cure of this chlorotic condition, not severe sunburning.

O T O.

CHOATE, JOSEPH HODGES (1832-1917), American lawyer, was born at Salem, Mass., Jan. 24, 1832. He began practicing law in New York City in 1855. He was one of the Committee of Seventy which in 1871 exposed the Tweed Ring (see TWEED, WILLIAM M.). In 1907 he was the first American delegate to the second Peace Congress at The Hague. He died at New York, May 14, 1917.

CHOATE, RUFUS (1799-1859), American lawyer and statesman, was born at Essex, Mass., on Oct. 1, 1799. He graduated at Dartmouth in 1819, was admitted to the bar in 1822, and practiced at Danvers, Salem and Boston. His impassioned rhetoric, wit, and picturesque personality soon won for him a pre-eminent place among the pleaders of his day. As a court room attorney, he had few peers. Following the death of Daniel Webster, he was generally recognized as the leader of the Massachusetts bar. Choate was one of the organizers of the Whig party in Massachusetts, and in 1841 was elected to the United States Senate to fill the unexpired term of Webster. Upon the expiration of his term, he returned to his law practice. At the Whig convention of 1852 he advocated the nomination of Webster as Presidential candidate, and in 1856 supported the candidate of the Democratic party, James Buchanan. He died at Halifax, N.S., on July 13, 1859. In 1915 he was elected to the American Hall of Fame.

CHOCANO, JOSÉ SANTOS (1876?-). Although Chocano is the best known of contemporary Peruvian poets, much uncertainty prevails as to the

year of his birth, which is variously given as 1867, 1875 and 1876. He has been heralded as the **WALT WHITMAN** of the South. Something of Whitman's vast vigors he does indeed share, but little of his technical freedom. As early as 1891 Chocano was attracting attention with his contributions to *El Peru ilustrado*; soon some of his anti-administration verses won him a jail sentence in Callo, from which he emerged in 1895, a rebel. His first volume, published in that year under the title of *Iras Santas*, was printed in red ink as the visible symbol of his radicalism. It was followed in the same year by *En la aldea*, a bucolic selection, which was printed in blue ink to symbolize in turn its campestrial character. Henceforth Chocano led the dual life of the successful Spanish-American poet, alternately issuing poetry and embarking upon diplomatic missions. In 1896 he was director of the periodical that first printed his verses. Later he founded a daily. From 1904 on he traveled in the service of his country, now to Colombia as Secretary of Legation, now as Chargé d'Affaires in Central America, again, in 1906, as Secretary of Legation in Madrid. He later traveled widely in Guatemala, in the United States, whither he came on a mission for President Cabrera, and in Cuba, Porto Rico and Mexico.

Chocano's poetry is marked by a loudly trumpeted Americanism that at times becomes pan-Americanism. His later works include *Azahares*, 1896; *La Epopeya del Morro*, 1899; *El Canto del Siglo*, 1899; *Selva Virgen*, 1900; *Poesías Completas*, 1902; *Fiat lux*, 1906, and *Alma América*, 1906. He wrote a number of dramas that were presented in Lima before 1905. For many years he was engaged on a "pantheistic epic" called *El Hombre-Sol*, or *The Man-Sun*, and dedicated to Bolívar. It was commissioned by President Leguía of Peru as part of the Peruvian centenary of Spanish-American Independence. Only the fourth canto, published in 1924 and dealing with Ayacucho and the Andes, has appeared. I. G.

See I. Goldberg, *Studies in Spanish-American Literature*, 1920.

CHOCOLATE, a preparation made from the seeds of the tropical tree, CACAO. The dried beans are cleaned, roasted, shelled, and winnowed. They are next blended and ground under heat and tremendous pressure until a smooth, ruddy liquor is obtained. Upon cooling, the liquor hardens, forming unsweetened or plain chocolate. Various sweetened chocolates are made by adding sugar, milk, vanilla, spices, cacao butter, etc. to plain chocolate liquor. Cocoa is made by extracting part of the cacao butter and pulverizing the remaining chocolate.

The word chocolate is often applied to a rich beverage made of chocolate, milk, sugar, and some water, that may be served hot or iced, with or without whipped cream. Chocolate beverages may be varied by the use of coffee, vanilla, cinnamon, mint, etc. Chocolate is more nutritious than cocoa because of its higher cacao butter content.

BIBLIOGRAPHY.—R. Whympier, *Cocoa and Chocolate; Their Chemistry and Manufacture*.

CHOCTAW, a Muskogean-speaking American Indian tribe which at the time of discovery was said to have had a population of between 15,000 and 20,000, and occupied central and southern Mississippi. The surviving Choctaw are now, in the main, in Oklahoma, though some are known in Mississippi and Louisiana. They were in close and friendly contact with the French, but continually at war with the Creek and Chickasaw. By the early 19th century they had begun to migrate to Oklahoma. They belong in the southeastern culture area.

CHOIR, in architecture, that part of a church reserved for the choir and clergy taking part in the service. Usually from the time of the mid-Romanesque down, it has been situated between the sanctuary, where the high altar is placed, and the nave, where the lay congregation sits. Since in a developed Gothic church of cross-shaped plan the choir space often extends from apse to crossing, the term choir is loosely used for the entire eastern arm of a church from the transept to the apse. In the early basilicas, the clergy were placed in the apse behind the altar; but later they were moved out to the other side, and separated by low screens from the open nave, as in San Clemente, in Rome. In the early Gothic non-monastic churches, the choir screens were often mere hangings, and the choir benches movable, but from the later 13th century on, the custom of building high solid choir screens, with rich permanent

although even in these churches, the word choir is often used architecturally for the eastern arm.

During the 18th and 19th centuries it became the custom to place the singing choir in a western gallery of the church, beneath the main organ, and that custom still persists in many Roman Catholic churches where paid lay choirs are used. In Protestant churches, however, and increasingly to-day in Roman Catholic churches, the singing choir is placed in stalls in the old position between the congregation and the high altar or Communion table, a scheme which allows the old richness of stall, screen, and **JUBE** or **Rood** beam.

CHOIR SCREEN, the pierced screen separating the choir or chancel—the two terms are virtually interchangeable—from the nave of a church. Sometimes it was continued eastward on both sides of the chancel, forming a back to the choir stalls. Occasionally the screen was of stone and supported the organ; more often it was of wood surmounted by a Calvary—the crucifix with statues of St. Mary and St. John. In French Gothic the tendency was toward light choir screens; the English were frequently heavier. Where the choir screen cut off the view of the high altar it was customary to erect another altar west of the screen.

CHOKEBERRY (*Aronia*), the name given to a group of attractive small shrubs of the rose family, closely related to the apple, native to swamps and low grounds in eastern North America and often grown as ornamentals. Among these are the red chokeberry (*A. arbutifolia*), the purple chokeberry (*A. floribunda*), and the black chokeberry (*A. melanocarpa*), so named from the color of their fruits. They bear white flowers in small clusters and berry-like pome fruits about the size of peas.

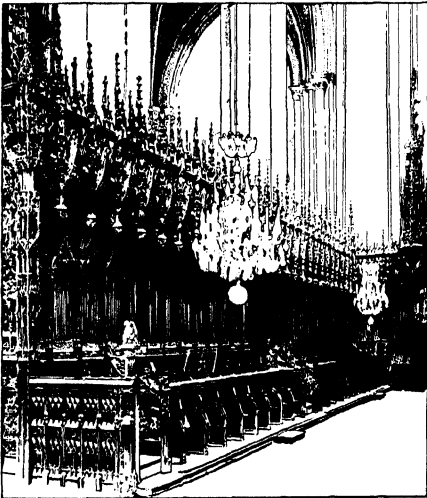
CHOKER COIL, an **INDUCTION COIL** which presents an **IMPEDANCE** path to alternating current. This impedance increases with **FREQUENCY**.

CHOKER DAMP. See **METHANE**.

CHOLEMIA. See **JAUNDICE**.

CHOLERA, ASIATIC, a specific infectious disease characterized by violent diarrhea, colicky pain and collapse. It is caused by the so-called comma bacillus, and transmitted through the stools and infected clothing of patients, by direct contact from person to person or simultaneously in a community contaminated water supply. It may also be conveyed by **CARRIERS OF DISEASE**.

A period of two to five days after exposure elapses before the symptoms manifest themselves in the gastrointestinal tract, with sudden extreme diarrhea, intestinal cramps, and depression. Fever may or may not be present. In the second stage, the diarrhea is markedly increased, with griping pains and persistent vomiting. There is great thirst and profound exhaustion, the tongue is white and the skin is shriveled. Perspiration is profuse, and the temperature at rectum is 103° to 105°F. while at the mouth it may be 5 to 10 degrees below normal. Grayish-white "rice-water" stools are delivered. The condition of the patient is



CHOIR STALLS OF THE CATHEDRAL OF NOTRE DAME, AMIENS

choir stalls, became more and more common. In the great English Gothic churches, which were almost without exception monastic in origin, the clergy enclosure was often of great size, bringing the ritual choir far down the nave, as in Westminster Abbey,

due to great loss of fluid from the blood, through sweating and the stools, and there is complete stopping in the flow of saliva and urine. The blood is thickened, and its volume reduced, so that the pressure within the blood vessels falls and the heart loses its activity. This stage may last a few hours, or from twelve to twenty-four. There may be uremia and acidosis, and the patient may sink into a coma. If death does not occur at this stage, a reaction sets in, due to destruction of the bacteria by the body; the heart action and function of the kidneys improve, and the patient gradually recovers. On the other hand, there may be a return of violent diarrhea or a condition similar to typhoid, and the patient may die during the relapse. There are often complications after recovery.

Besides the use of various procedures to relieve the condition of the patient, treatment is naturally directed toward killing the bacteria in the intestine and to restoring the normal blood volume. In the former, doses of potassium permanganate given to kill the bacteria and kaolin to absorb their poisons have been combined successfully. The blood volume is restored by injecting salt solutions into the veins. Protective vaccination has been used with success in the Balkan armies in the Balkan and World Wars.

There have been in the past great epidemics of cholera in various countries, with mortality of from 30 to 80 per cent. These have generally originated in Asia and were spread along travel routes by pilgrims or carried to more distant countries by ships.

The most important means of eradication of the disease is prophylaxis. Quarantines are instituted in various countries and persons attacked are isolated. During epidemics care should be taken in the disinfection of stools and clothing of patients; drinking water and milk should be boiled; no vegetables should be eaten uncooked and digestive disturbances should be promptly treated.

CHOLLA (pron. cho-yah), a shrubby or tree-like exceedingly spiny cactus (*Opuntia fulgida*), native to Arizona and adjacent Mexico. It grows about 10 ft. high, with a stout trunk, sometimes a foot in diameter, and numerous spreading branches, congested at their ends with oblong, fleshy branchlets or joints. The joints break off very readily, and, upon falling to the ground, grow into new plants. Being densely covered, as are most other parts of the plant, with strong, needle-sharp, barbed spines, the joints readily become attached to the skins of grazing animals, which frequently carry them many miles before they fall off, thus distributing the plant widely in pastured districts. The cholla bears numerous rose-red flowers and green, pear-shaped fruit.

CHOLON, a city of French Indo-China, the industrial center of Cochinchina, $3\frac{1}{2}$ mi. southwest of Saigon, with which it is connected by canal, railways and roads. There are several rice mills which clean hundreds of thousands of tons of rice annually. Cambodia alone exports 150,000 tons via the mills of Cholon and the wharfs of Saigon. There are also

saw mills, soap and varnish factories. Glass, brick and pottery are manufactured. There have been many improvements by the French, including schools, electric light plants, and sanitation systems. Est. pop. 1930, 294,316.

CHOMEDEY, PAUL DE, SIEUR DE MAISONNEUVE (1612-76), founder of Montreal, was born in 1612. Expecting to establish a religious community in New France, he founded in 1642 Ville Marie-de-Montreal, later Montreal, on the site of the Indian village of *Hochelaga* and Champlain's Mount Royal. There he served as governor until 1664. He was recalled to France in 1665, and died there in 1676.

CHOMUTOV (German *Komotau*), a Czechoslovak city in northwestern Bohemia. The city has a market place surrounded by arcades, a late-Gothic Catholic church, former Jesuit church, Protestant church, synagogue, a castle built in 1520, which is now a city hall with a museum, and a municipal park. Among the industries are a rolling mill and sheet metal and chemical factories. Lignite is produced in the immediate neighborhood in large quantities. Chomutov was a possession of the Teutonic Order in the 13th and 14th centuries, was conquered by the Hussites in 1421 and made a royal city in 1605. The inhabitants are mostly Germans. Pop. 1930, 33,266.

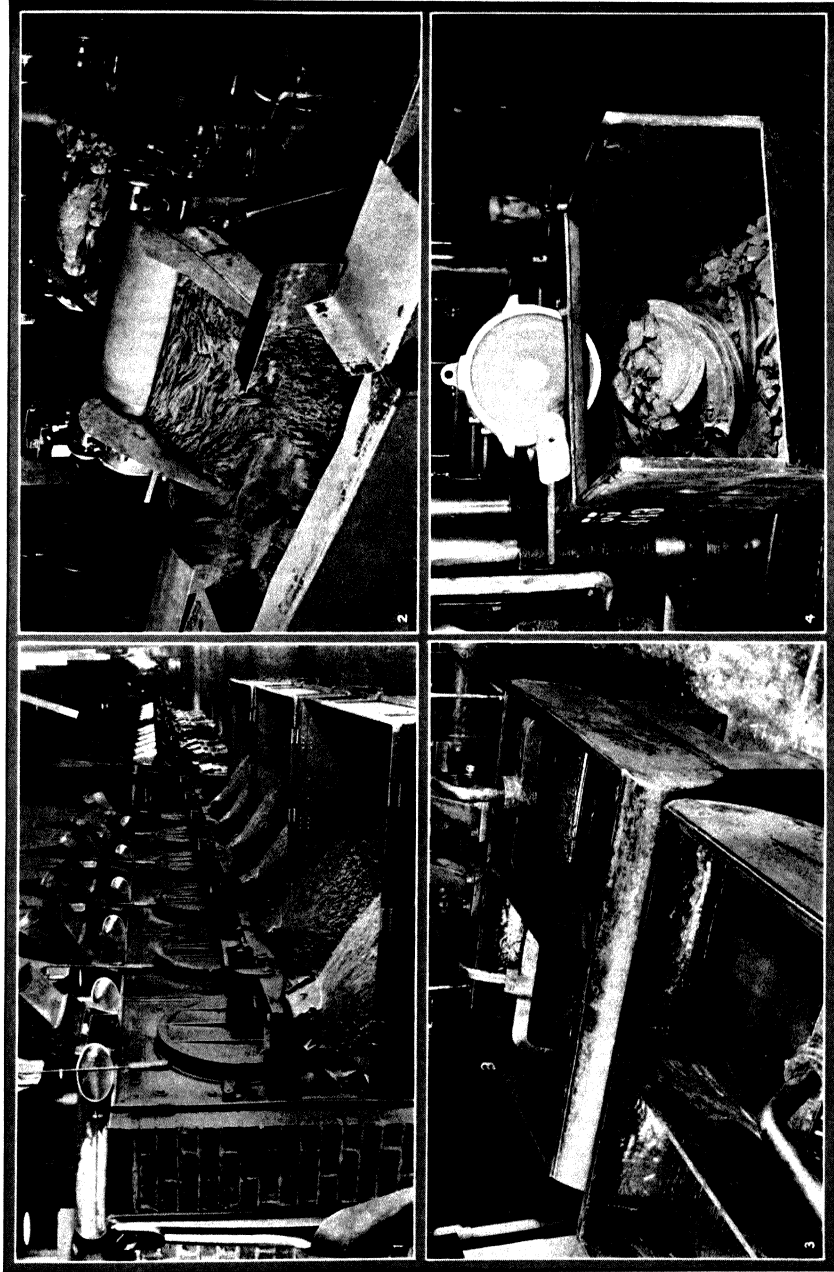
CHOPIN, FRANÇOIS-FREDERIC (1810-49), Polish composer, was born in Zelazowa Wola, near Warsaw, on Feb. 22, 1810. His father, Nicolas Chopin, was French, while his mother, Justine Kryzhanowska, was Polish. This mixed strain manifested itself conspicuously in his music which, suave and witty on the surface, is internally melancholy and tempestuous. After studying as a youth with Zywny and Elsner, he journeyed to Paris, Vienna and Munich, where his success as a virtuoso was instantaneous. SCHUMANN speedily recognized his creative talent. In a short time Chopin was well established in the cultural circles of Europe, numbering among his friends such celebrities as Balzac, Heine, Liszt, Berlioz, and Mendelssohn. In 1837 he met GEORGE SAND (Mme. Dudevant), accompanying her to the island of Majorca the following year and returning to France in 1839. The relationship was disrupted in 1847. He contracted tuberculosis, and a naturally fragile constitution succumbed rapidly to the ravages of that disease.

As a composer for the pianoforte Chopin was unique, and he wisely confined his efforts almost exclusively to that instrument. Chief among these piano works are 2 concertos, 3 sonatas, 4 ballades, a barcarolle and a berceuse, 19 nocturnes, 13 waltzes, 12 polonaises, 4 scherzos, 25 preludes, and 52 mazurkas. He died at Paris, Oct. 17, 1849.

BIBLIOGRAPHY.—Frederick Niecks, *Frederic Chopin as Man and Musician*; J. G. Huneker, *Chopin, the Man and His Music*.

CHORALE, a stately sacred air harmonized for congregational singing in the Protestant church. It took its rise in Germany under MARTIN LUTHER who felt that the unmeasured Gregorian music did not

CHOCOLATE



MANUFACTURING COCOA AND CHOCOLATE

1. Ovens for roasting cacao beans.
2. Milling chocolate.
3. Smoothing chocolate in longitudinal vats.
4. Cakes of pressed cocoa.

satisfy the rhythmical needs of the people, and he himself composed numerous works of this character, the most famous of which, *Ein feste Burg*, remains to this day one of the finest chorals in existence. Unlike the hymn, the chorale is broken into sections which terminate on long pauses, aiding a massive declamation, but except for this and for its performance throughout in a more ponderous manner, the choral and hymn might be termed identical. On the foundation of many of these majestic airs of the Lutheran church, J. S. BACH wove contrapuntal melodies, thus producing his noble chorale preludes for the organ.

CHORD, in music, a group of tones sounded simultaneously, either unpleasant in effect, in which case it is called a dissonance or discord, or pleasant, in which case it is called a consonance or concord. The construction and connection of chords is called, as a study, **HARMONY**. All so-called common chords are based on one or another **TRIAD**; these furnish the concords of music. Discords, chords of the seventh, ninth, eleventh, and thirteenth are the aforesaid triads to which have been added, respectively, one third, two thirds, three thirds, and four thirds; these chords furnish practically the entire discordant feature of music, save for **SUSPENSIONS**. Viewed generally, a chord is any group of tones whatsoever, whether the tones are discordant or concordant or a mixture, and whether the number of tones is few or many. However, two tones are commonly called a dyad, three tones, arranged according to the rules of harmony, a triad, and four tones, similarly arranged, a chord proper. In fundamental harmony four tones are both the maximum and the minimum number of tones used, since all common chords and chords of the seventh, whether in **FUNDAMENTAL POSITION** or in **INVERSION**, can be expressed by four tones only; additional tones are secured by what is known as doubling, that is, repeating one or more of the tones in a different octave. The "chord of nature" is a chord formed by the first six partials or overtones which are yielded by a single tone according to certain laws of acoustics.

CHOREA, a disease of the nervous system characterized chiefly by involuntary movements of the muscles of the body. It is commonly known as **St. Vitus' Dance**, is mainly a disease of childhood and is much more common in girls than in boys, the proportion being more than two to one. The ages of greatest liability are between five and fifteen years. It is more common in urban than in rural districts, and in the lower than in the upper classes. The greatest number of cases occur in the first three months of the year, and the children are the quick, bright, intelligent type. The disease is rare in Negroes.

Chorea is closely linked with **TONSILLITIS**, **RHEUMATIC FEVER** and rheumatic heart disease (see **HEART DISEASE**), chorea frequently occurring after one of these diseases. The heart is often affected in the same manner after an attack of chorea or of rheumatic fever.

The disease may begin abruptly but usually the onset is gradual. The child is restless and unable to sit still. He is clumsy, shuffles his feet, drops things and knocks them about. He is irritable, cross and unmanageable, cries on slight provocation, and is emotionally unbalanced. Twitching of the muscles of the face, and jerky movements of the body and extremities, the involuntary movements characteristic of the disease, are noticed.

Three groups may be recognized: the mild, in which the affection of the muscles is slight, the speech only slightly involved, and the general health little disturbed, the severe, in which the movements are general, the power of speech is lost, and the patient is unable to walk, feed himself, or help himself in any manner; and finally the maniacal form, characterized by profound cerebral disturbances.

The cardinal points in the treatment of a case of chorea should be to promote rest of mind and body, to secure adequate sleep, to prevent injury from the choreiform movements, to maintain the general nutrition, and to bring about a cessation of the movements. Further, the endeavor should be made to reduce as far as possible the risk of complications in the heart. Every effort must be made to aid the reestablishment of muscular co-ordination by removing any source of irritation which may have an influence on the disease.

Absolute rest in bed, complete isolation and soothing warm baths and an ample nourishing diet are the most important general measures. Certain drugs and sedatives are valuable. A mild case of chorea kept at rest will usually recover in from four to eight weeks, though the period may vary from one day to more than a year. More recently treatment by fever, artificially produced through injection of a non-specific protein, has been recommended. A. F. A.

CHOROIDITIS. See **BLINDNESS**, **MEDICAL ASPECTS OF**; **EYE AFFECTIONS OF**.

CHOROTEGA, a linguistic stock of Central American Indians which have now lost all tribal identity. They formerly inhabited the west coasts of Honduras, Nicaragua and Costa Rica, and southern Mexico. The name Chorotega means "driven out people," and dates from a period toward the end of the **TOLTEC** supremacy when a group of tribes moved northward into southern Mexico. Whether these Indians were actually forced to move or did so of their own volition is not known. Remains of their art work consist chiefly of stone carvings and pottery showing a definite Mayan influence.

CHOSEN, a country about the size of the state of Minnesota, lying between the Yellow Sea and the Sea of Japan. The area of Chosen is 85,229 sq. mi. with a population of 22,000,000. The northeastern frontier joins South Manchuria for 500 mi. and for a few miles, Siberia. Geographically, Chosen serves as a bridge between China and Japan and has been of great importance in transmitting the culture of the former to the latter.

Because the Everlasting White Mountain Range runs the length of the peninsula along the eastern

coast, nearly all the good harbors are in the west, the coast-line of the east presenting a difficult and forbidding aspect. The coast-line is about 5,000 mi. excluding the islands, with the principal harbors in the west: Wonsan, Fusan, Masanpo, Mokpo, Chemulpo and Chin-nampo.

The arable lands and the principal rivers are on the western sides. The longest river, the Yalu, navigable by small steamers as far as Antung, 30 mi. from the sea, flows from the Chang Pai range in Manchuria into the Korean Bay of the Yellow Sea. It forms the boundary between Korea and Manchuria. The Tumen River, separating Russia from Chosen, runs from the same mountain northeastward into the Gulf of Peter the Great. The Han River starts from the famous Diamond Mountain and flows down through the capital, Keijo (Seoul).

The climate of Chosen, that of the north-temperate zone, has been called ideal, with crisp dry winters abounding in snow, and with intense summers in which the heat is not oppressive, because of the absence of humidity. The country is rich in mineral resources, in gold, silver, tungsten, graphite, copper, iron and coal, largely untouched. The racial characteristics of the Chosenese are distinct and differ from Chinese or Japanese, showing a combination of the Malays, the Mongols and the Caucasians.

History. The history of Chosen goes back to 2333 B.C. when the first ruler, Tan-Kun, founded the kingdom of Chosen in Southern Manchuria. In 1122 B.C. Ki Ja brought in Chinese culture from China. The period of the Three Hans follows, of Ma-Han in the central part, Chin-Han in the southeastern, and Byung-Han in the southwestern. Then comes the Golden Age of the Three Kingdoms: Koguryu in the north (37 B.C.-668 A.D.), Paikche in the southwest (57 B.C.-935 A.D.), and Silla in the southeast (57 B.C.-935 A.D.). Korean civilization was at its zenith at this time, and Chinese, Japanese, Persians and Hindoos came to study art and science at Kyungju, the seat of the famous astronomical observatory built by a Korean queen in 647 A.D. During this period the country came to be called Korea.

Y. K.

The Koryu dynasty (918-1392), completed the unification of the whole country with its capital at Sangdo. The Yi dynasty which followed, lasted until Korea was annexed by Japan in 1910. Prior to that, Korea for centuries had been under China's nominal suzerainty, though the actual status of control, especially in foreign relations, was uncertain. This uncertainty led to a number of international incidents and considerable confusion during the latter part of the 19th century, which were one of the principal causes of the SINO-JAPANESE WAR of 1894-95, as one result of which China and Japan agreed to recognize Korea's independence. Attempted Russian penetration into Korea contributed to the uneasiness in Japan which led to the RUSSO-JAPANESE WAR of 1904-5. After that war Japan established what in effect was a protectorate over Korea, par-

ticularly in foreign relations. This protectorate was transformed into formal annexation in August, 1910, in spite of earlier Japanese pledges to respect Korea's independence. The Japanese position was that Japan must exercise this control in order to protect herself against danger from foreign invasion through Korea, particularly since the weakness and corruption of the Korean administration made impossible effective control by the Korean authorities. When Japan annexed Korea it changed the name of the country to its earlier name, Chosen, and changed the name of the capital from Seoul to Keijo.

The Japanese set up an administration in Chosen paralleling roughly that of the provinces in Japan, but with a Governor-general at the head. They proceeded to make many improvements in the roads, railways, harbors, etc. They also opened many schools, for both Chosenese and Japanese. The Chosenese, however, resented bitterly their loss of independence, and Japan has maintained rigid military and police control to suppress the Chosenese independence efforts. Chosenese independence leaders, nevertheless, in 1919 set up a "revolutionary government" with headquarters outside the country.

In spite of the improvement in transportation, sanitation, etc., which the Japanese have brought to Chosen, the lot of the ordinary Chosenese peasant has not been greatly improved. Continuing poverty, owing in part to successive years of drought, and hatred of the Japanese rule have caused hundreds of thousands of Chosenese to move across the borders into MANCHURIA. The Japanese contend that these migrants still are Japanese subjects; the migrants themselves generally seek to merge themselves into the Chinese communities as rapidly as possible. The presence of these Chosenese settlers in Manchuria has been the cause of considerable friction between China and Japan.

G. C.

BIBLIOGRAPHY—H. B. Hulbert, *The History of Korea*, 1905; H. B. Hulbert, *The Passing of Korea*, 1906; F. A. MacKenzie, *The Tragedy of Korea*, 1908; Henry Chung, *The Case of Korea*, 1922; Alleyne Ireland, *The New Korea*, 1926; Young-hill Kang, *The Grass Roof*, 1931.

CHOSHU, the name of one of the two principal feudal clans in Japan at the time of the Restoration of 1868. The Choshu clan had its headquarters at Yamaguchi, near the western end of the principal Japanese island, Honshu. The Choshu leaders, like their rivals of the Satsuma clan, strongly supported the unification of Japan under the emperor and the modernization developments which were launched. The Choshu interest was chiefly in the army, as distinct from the navy with which the Satsuma clan concerned itself. Sharp rivalry between the Choshu and Satsuma clans continued for many years.

CHOUGH, a genus (*Pyrhocorax*) of large Old World birds of the crow family with glossy black plumage and brilliant red feet. The red-billed chough (*P. gracules*), closely resembling the jackdaw in appearance and habits, is now found chiefly about sea cliffs or in the high mountainous regions of Europe and northern Africa, nesting in large communities

on inaccessible cliffs. The Alpine chough (*P. alpinus*), a yellow-billed species, occurs at high elevations from southern Europe to the Himalayas.

CHOUSINGHA (*Tetracos quadricornis*), also called chikara, a small, goat-like antelope of eastern India. It is distinguished from all other extant ruminants by the buck's having two pairs of horns; whence the name four-horned antelope, by which it is sometimes known. The horns are conical. The smaller, about 2 in. high, are placed above the eyes, the larger, about twice that height, rise back of them, closer to the ears. At the withers the male stands 25 in.; at the haunches it is somewhat taller. In habits as well as appearance chousinghas more nearly resemble South African duikerboks than other Indian antelopes. The fur, pale-brown in color above, shading to light below, is rough, short and sparse. They go either singly or in pairs, never in flocks, and they avoid dense jungles, preferring thin woods, or bush, or long grass, and always keeping near water to be able to drink daily. They are shy and when discovered bound away something like a hare.

CHRÉTIEN DE TROYES, 12th century French poet and originator of the medieval romance, was born probably at Troyes, in Champagne, some time between 1140 and 1150. He is famous for his development of the ARTHURIAN LEGENDS. His works based on these legends include *Le Chevalier de la Charrette*; *Erec* used by Tennyson in his *IDYLLS OF THE KING*; and *Le Conte du Graal*, the basis for Wagner's *PARSIFAL*. Chrétien's poems were written for the women of the court of Marie de Champagne and all exemplify the ideals of courtly love. See also *ROMANCE*.

CHRISM (Greek *chrisma*, ointment), the solemnly consecrated oil used in certain ceremonies in the Greek and Roman Catholic churches. In the Christian church it symbolizes the inspiration of the Divine Spirit. In Old Testament times the prophets, priests and kings were anointed upon taking office. As early as the 3rd century oil specially blessed by the bishop was used at baptisms. Chrism is used at confirmation, ordination, extreme unction, coronation and consecration of churches and sacred utensils. It is always applied in the form of the cross. Originally the chrism was olive oil, but was later mixed with balsam and other sweet-smelling substances.

CHRIST. See *JESUS*.

CHRISTABEL, the title character of a remarkable unfinished poem by Coleridge; published 1816. 2. The heroine of "Sir Caulin," a ballad of tragic love in Percy's *Reliques*, 1765. 3. The heroine of an old romance, *Sir Eglamour of Artois*.

CHRISTADELPHIANS, or Brothers of Christ, the name adopted by the followers of Dr. John Thomas, an English physician who came to the United States in 1844. He established societies in the United States, Canada and Great Britain, "taking out of the Gentiles a People for his Name." The Christadelphians, while not accepting the Trinity, hold that Christ was son of God and son of man, and that the

Holy Spirit is an "effluence" of divine power. They believe that the soul is by nature mortal, that eternal life is only for the righteous and that Christ will soon return. A Christadelphian organization is called an *Ecclesia* and is congregational in polity. Each Ecclesia elects from its own body presiding brethren, managing brethren and other officers, who conduct its services and business. The Christadelphians have no appointed ministers, and their missionaries no regular salaries.

CHRISTCHURCH, a capital of Canterbury province, NEW ZEALAND, situated near the center of South Island's eastern coast on the Avon River. The city has a number of fine buildings and parks. Among the former may be mentioned the beautiful Anglican cathedral, and Canterbury College. Hagley Park, embracing 400 acres, is the largest public recreation ground in the Dominion. The primary industries are the preparation of mutton, wool and wheat; the secondary, such as meat freezing and preserving, tanning and fellmongery are allied to these.

Christchurch, called the "City of the Plains," was founded in 1848 by the "Canterbury Pilgrims," an expedition of six ships and 1,200 passengers from England. Pop. 1931, 89,500.

CHRISTIAN, the name of ten kings of Denmark: Christian I (1426-81), son of the Count of Oldenburg and Delmenhorst and Hedwig of Holstein, married the widow of Christopher of Denmark and Norway and was elected to succeed him as King. He seized the Swedish crown which he later lost; he was chosen Duke of Schleswig and Count of Holstein in personal union with Denmark. Christian II (1481-1559), suppressed uprisings in Norway and was recognized as King in Sweden, but lost that crown after the execution of 600. He was deposed in Denmark also and imprisoned. Christian III (1503-59), embraced the Reformation and furthered education, agriculture and industry. Christian IV (1577-1648), was beloved by his subjects for improving the condition of country and people. Christian V (1646-99), acquired Oldenburg and Delmenhorst, and the West Indian Islands St. Thomas and St. John, and also furthered commerce and industry. Christian VI (1699-1746), introduced a puritanical régime. Christian VII (1749-1808), debauched and mentally unbalanced, ruled nominally under the regency of his step-brother. Christian VIII (1786-1848), was elected King of Norway when that country fell to Sweden, but had to return to Denmark, where he conducted an autocratic régime. Christian IX (1818-1906), of Schleswig-Holstein, was elected to succeed to the last male of the extinct dynasty, and was called the Grandfather of Europe on account of his many royal relatives. Christian X (1870-), was crowned King in 1912 and, together with the two other Scandinavian countries, he maintained the neutrality of Denmark, confirmed a democratic constitution and sold the Virgin Islands to the United States.

CHRISTIAN IV (1577-1648), King of Denmark and Norway, 1588-1648, the son of Frederick II, was

born at Fredriksborg, Apr. 12, 1577. In 1611-13 he carried on a successful war with Sweden. In the THIRTY YEARS WAR he joined the Protestants and was defeated by Tilly and compelled to accept the peace of Lubeck, May, 1629. A second war with Sweden cost him the Norwegian districts of Jemtland and Herje-land and the islands of Gothland and Osel. He died at Copenhagen, Feb. 28, 1648.

CHRISTIAN X (1870-), King of Denmark, was born at Charlottenlund, near Copenhagen, Sept. 26, 1870, and succeeded to the throne on the death of his father Frederick VIII, May 14, 1912. On Apr. 26, 1898 he married Princess Alexandrine, daughter of Grand Duke Friedrich-Franz III of Mecklenburg-Schwerin. During the reign of Christian X the constitution of Denmark has been liberalized with his approval, the franchise being extended to men and women aged 25.

CHRISTIAN AND MISSIONARY ALLIANCE, THE, was originated in 1881 by Dr. A. B. Simpson, a Presbyterian clergyman of New York City, who withdrew from the presbytery to conduct evangelistic work "among the unchurched masses." Early in the history of the movement an independent church, known as the Gospel Tabernacle Church, was legally chartered in New York, and later other Gospel Missions combined to form the Alliance. In doctrine the Alliance is strongly evangelistic but has no fixed creed. It stresses "the fourfold gospel of Christ, as Savior, Sanctifier, Healer and Coming Lord." The Alliance seeks to avoid sectarian activity, and many of its supporters are members of various Protestant churches. It is strongest in Pennsylvania, New York and Ohio, but it is active in 10 other states, as well as in Canada, the West Indies and South America, and conducts missionary work in Africa and various countries of the Orient. The foreign missionaries of the Alliance outnumber their pastors in the home country.

CHRISTIAN ART. The principles underlying Christian art were contained in the religion to which that art gave outer expression. Christianity, while its development has been along Western lines, is Oriental in origin, and sprang to life from the intellectual and religious soil of Judaism. The national Hebraic Messianic idea was translated by its founder, Jesus Christ, into a universal spiritual kingdom, and abstract doctrinal concepts into direct conscious communion with God, accessible to every one through the leading of a life of which He was the exemplar. As in the history of all great religions, the purity of the teachings of the founder of Christianity was later to be colored. The mysticism of Asia, the philosophy of the Greeks, and the genius for external organization of the Roman Empire all contributed to the modification of the teachings of Christ.

Judaism, a monotheistic religion, forbade, through fear of idolatry, the representation of man, animals or plants. The prohibition was aimed primarily at the method; no figure could be raised or protrude from the background, but might be incised or sunken.

During the life of Christ and his apostles there is no evidence of representative Christian art, the first being the crude paintings in the CATACOMBS. It was the art of the common people, infinitely below the technique of the Roman art being painted in the sunlight above these crypts, in the decadent palaces, as that preserved in the House of Livia. It was a symbolic art, purely didactic, without sense of artistic accomplishment, and conforming to the inherited principles of abstract formula, for many of these early Christians were former Oriental slaves.

With no historic background, prior to that of its founder, early Christianity took over the whole history of the Old Testament, and this it presented to the world for the first time through a type of picture writing, transposing it to its own point of view, and permeating it with a new spirit, turning the mind from things seen to things unseen but felt. Christ as the "Beautiful Shepherd" was the principal theme; an exceedingly human Father with the mind of a poet, who presented ethics to the world under the aspect of beauty. He thought and taught in the pictures of flowers and birds, and the loveliness of little children. It was this spirit the primitive Christian artists caught; but it was to be lost to Christian art for 1000 years, through the proclamation of Christianity as the official state religion of the Roman Empire under the acceptance of the new faith by Constantine in 313, from which date Christian Art became essentially a Church art. Christianity, poor and despised, harried into dark crypts, is suddenly brought into imperial favor. The new basilicas with their vast wall spaces, erected for the public worship of large congregations, demanded an immediate and wholly new art, ceremonial and sumptuous; and at the same time could illustrate and elucidate points of dogma.

At Rome the mystical spirit of the East, with its transcendental, emotional appeal, had already interpenetrated by color, in the shape of mosaic and enamels, the perfection of form of the West, controlled by mind and will. Accepting the existing arts as they stood, a change was brought about by giving them a new content, modifying them from within, giving to their symbolic meaning new spiritual values, but not reaching a fusion of the spirit of the East and the West into a perfected Christian art expression until the 12th and 13th centuries. The realistic imperial mode was given a hieratic treatment in mosaic, with a shimmering gold background. The art of the common people becomes more dogmatic and less mystic in its symbolism, more imperial and ecclesiastical. The Beautiful Shepherd disappears and Christ the Pantokrator replaces the deified Roman Emperor. Although Constantine had exacted an oath from the Christians never to worship an image, the pagan love for sculptured form had not died out, but whatever was accomplished in Christian sculpture was obliterated by the fury of the iconoclasts of the 8th and 9th centuries. We know of it only through the exquisite carved ivories, which were purely Byzantine and were

to be the great inspiration of the Gothic sculptors. With the fall of the Roman Empire Greco-Roman sculpture reached its lowest ebb and ceased to exist as such. Mosaic art reached an unparalleled splendor in the late 5th century at Ravenna, which was for a time the capital of the Roman Empire. CHARLEMAGNE charted the course for western Christian art for an interim early in the 9th century, many of the best Byzantine artists fleeing to his court from the fury of the iconoclasts. The ground he prepared was to lie fallow for several centuries, then to bring forth a harvest of Christian art which had its efflorescence in the 16th century.

The story of the springtime blossoming of western Christian art is told in the article on ITALIAN PRIMITIVES. The dominating temporal and spiritual supremacy of the Church offered little spiritual nourishment and art passed into its service with an ever-increasing trend toward narrative naturalism. The successive periods of ROMANESQUE, GOTHIC and RENAISSANCE are also described in separate articles. While the religious subject was retained throughout, as scientific technique and intellectual interest in pagan mythology developed, the inner springs of spiritual content dried up and sacred subjects became merely material for display of technique; no attempt was made to pry behind the veil of the obvious. DA VINCI in his notebooks warns the artist that he unconsciously expresses himself in his subject to a degree that he imparts to it his own hand and eye. The material pomp and struggle of the late Renaissance was the seed time of Christian art, and a new springtime has not yet arrived. To free humanity from the grip of matter in which it was entangled it was necessary that Spirit be incarnated in man. If the Renaissance was a failure it was because Christianity at that time failed; because as a whole it then, and since, has not been tried. See also MADONNAS in ART.

BIBLIOGRAPHY —P. Gardner, *Principles of Christian Art*, 1928; G. G. Coulton, *Art and the Reformation*, 1928

CHRISTIAN BROTHERS, a Roman Catholic society, the members of which take the three religious vows, and devote themselves to the education of youth. The society is credited with having greatly furthered the cause of primary education in France. Founded by Jean Baptiste de la Salle in 1680, the Brothers substituted the group method of instruction for the individual. They forbade the teaching of Latin that they might better serve the poorer classes.

The teaching methods and ideals of the Christian Brothers are set forth in their two manuals, *Government of the Christian Schools* and *Twelve Virtues of a Good Master*. The subjects taught include ethics, literature, philosophy, mathematics and physics. The Christian Brothers' college for the training of teachers, established in 1684, was a pioneer in its field. The principal aim of the brotherhood is to establish free elementary schools for poor children. The order has been twice suppressed; yet its work has prospered. Altogether more than 1,600 schools have been established with 15,500 teachers of the brotherhood, and

350,000 pupils. These schools have been founded on both sides of the Atlantic, and even in India and South Africa.

CHRISTIAN CHURCH (General Convention of the Christian Church), a group having no creed or statement of doctrine other than the Bible itself and basing requirements for membership on Christian character. Their interpretation of Scripture is generally the same as that of other evangelical denominations but no person is barred from membership because of differences in theological belief. In accordance with their liberal views, baptism, though generally practised, is not required. The Christian Church had its beginnings shortly after the War of the Revolution as a result of the attempted enforcement of ecclesiastical discipline. The pioneer in the movement of revolt was the Rev. James O'Kelley, a Methodist minister in Virginia. With a number of followers he withdrew from the Methodist Episcopal church in 1792 and organized the "Republican Methodists." This name was changed in 1794 to "Christians." A similar movement started in 1800 among the Baptists of New England under the leadership of Dr. Abner Jones and Elias Smith and also among the Presbyterians of Kentucky and Tennessee. The first general conference met in 1819 at Portsmouth, N.H. The group has gone through many phases of organization and has been known by various names. In 1922 the title Christian Church (The General Convention of the Christian Church) was adopted. Seven years later the Christian Church united with the CONGREGATIONALISTS. Seven institutes and colleges in the United States are under their jurisdiction. *The Herald of Gospel Liberty*, the denomination organ founded by Elias Smith in 1808, is the oldest religious newspaper in the United States published in the English language. In 1929 it was merged with *The Congregationalist*, and the combined paper is now known as *The Congregationalist and Herald of Gospel Liberty*. The church has a membership of 112,795, in 1,044 local organizations.

CHRISTIAN ENDEAVOR, YOUNG PEOPLE'S SOCIETY OF, an international and interdenominational society for promoting the spiritual life of young people. It was organized in 1881 at the Congregational Church in Portland, Maine, served by the Rev. Francis E. Clark, D.D. (1851-1927). It adopted the motto, "For Christ and the Church" and soon spread widely. It was established in Great Britain and Australasia in 1888 and has since been organized in every land on the globe where Christian evangelical missionaries operate. Its membership constitution is printed in 80 different languages. It has "Floating Societies" on the ships of the United States and the British navies and has a large number of societies at army posts and in numerous prisons. Its national conventions have been attended by from 10,000 to 50,000 delegates. A Junior Society was formed in 1884, an Intermediate one later, and a Mothers' Society in 1893. The World's Christian Endeavor Union was formed in 1895. Its membership is chiefly

drawn from young people under the influence of the nonepiscopal churches, and any society belonging to an evangelical church, approving of its leading principles, is admitted to the union. The aim of the society is to train and cultivate religious self-expression, and all active members promise to take some part in the weekly prayer meetings. Various committees provide for other activities, such as committees on missionary work, temperance, good literature, music and relief.

CHRISTIANIA. See OSLO.

CHRISTIANITY, the religion of Christians. Like Puritan and Jesuit, Christian was originally a nickname; it was coined by the acute, witty citizens of Syrian Antioch a few years after the death of Jesus, in order to differentiate his followers from Jews and pagans. By this time it was becoming clear that the faith of those who adhered to the new movement linked them to Jesus as Christ, i.e., as appointed by God for a special divine mission. The disciples were first called Christians in Antioch. The new movement, which had already gone beyond the Judaism in which it originated, required a new name, and the name was derived from a title which had become a personal name for Jesus. Originally the faithful were not called after Jesus. They were disciples, not as philosophical students were disciples of Plato or Socrates but because they worshiped Jesus as the Christ of God.

Dominant Note of New Religion. It was not the wisdom of Jesus or his teaching that inspired the early Church, but faith in him as risen. The Christian religion from the outset was the religion which streamed from the Saving Act of God in the mission of Jesus, His Son and Servant, a mission which had culminated in his resurrection from the dead. The experiences of the Spirit which followed marked the inauguration of the final period to which belief in the Christ, or Messiah, had pointed within the faith of later Israel. Consequently the dominant note of the new movement was the conviction that God's self-revelation in the person of Jesus the Christ denoted His full and final action in and for His people. The literature of the community witnesses to this belief. Especially in the New Testament, a selection from the writings of the primitive period, there is presupposed such a relationship to God, on the part of Christians. "God was in Christ reconciling the world to Himself." "You who by him do believe in God, that raised him from the dead." "Great (profound) is the mystery of our religion: It is He who was manifest in the flesh, justified by the Spirit," i.e., at the resurrection. There was a variety of interpretations, and as yet no single expression of the belief commanded widespread assent. But the changes of thought and language which the faith underwent never touched its essential content, and by the time that the earliest symbol of creed was drawn up, for a confession of faith by catechumens on entering the Church, i.e., the so-called Apostles' Creed, the conviction of the living Jesus as Lord was enshrined in the hearts of the faithful. They worshiped God as they

remembered Jesus and also as they were conscious of His presence through communion with the Lord His Son, their Saviour, who had disclosed His redeeming love and saving purpose for mankind. "The most distinctive characteristic of Christian doctrine, as compared with that of other religions of the time, was the conception of a 'Saviour,' i.e., a divine Person who has descended from a higher world to rescue human souls from their fallen condition." (Walter Scott, *Hermetica* ii. 9.) The religion was redemptive, historical and non-racial.

Throughout the early centuries, as Christianity threw itself upon the world of contemporary thought and belief, this faith was engaged in stating how the divine Christ was related to God, in maintaining His historical reality, and in explaining the redemptive significance of His mission. These were, as they still are, the main aspects of Christianity which demand reinterpretation. The unity of God was eventually found to involve what has been called a trinitarian conception of personality in the divine nature; the distinction between Jesus the Lord and either an ordinary rabbi of his day or a so-called saviour-god of the mystery-religions had to be made clear; and the problem of sin and evil raised questions which are still unanswered. Christianity, originally Semitic in its outlook, entered into the Greek and Roman world with a vital power of assimilation, not shrinking from the current questions of providence and morality, but claiming to have the clue to such mysteries in its inherent faith. The contact with this larger world was vivifying, and though the doctrinal solutions reached are not formally adequate, they have the double merit of revealing the essentials which the faith sought to conserve and at the same time the need of interpreting these essentials in the light of the truest science of the day.

Division in the Church. Meantime, however, the political and social relations of the faith led to a new adjustment which proved important for subsequent ages. It took 300 years, as long as the period between modern Christianity and the opening of the 17th century, for the early Church to win the right of existence from the Roman state, and when it triumphed, largely as the result of what the martyrs achieved, it gained more than it had ventured to expect, namely recognition as the religion of the state. By this time Judaism had relapsed into a national cult, whilst the large majority of the pagan cults, hitherto Christianity's most serious rivals, had lost their appeal. Christianity in the 4th century entered upon its political phase. It was a religion for all men, drawing adherents from any race. But now it became the religion of the dominant power in the world. One result of this connection was a division in the Church. The founding of Constantinople as a new Christian capital had the unexpected result of accentuating differences between Eastern and Western Christendom, until finally in the 11th century the Catholic Church as an organization was divided. Under the bishop of Rome the Latin Church con-

tinued its career in Europe, consolidating its position under, or rather as part of, the Holy Roman Empire, until it suffered a further rupture in the 16th century. The great Eastern Church (see EASTERN ORTHODOX CHURCH), though sorely damaged by the rise of Islam in the 7th century and by the Crusading movement, continued to uphold the Catholic faith, while the Greek Empire was protecting Europe from the Turks till the 15th century. Even after that crisis, the Eastern Church maintained its missions, though now more to the north of Europe than in the far East. The latter was opened up to Christianity by the brilliant explorations of Portugal in the 15th and 16th centuries, just as the Spanish discoveries across the Atlantic at the same period paved the way for the expansion of Western Christianity in America.

The Eastern Church which, with its own monasticism and mysticism, preserved a type of Catholic Christianity differing from that of the Latin Church in Europe, produced no series of powerful thinkers like the medieval Scholastics. The latter did for their day what requires to be done afresh at the present day; i.e., a synthesis was provided of the Catholic faith which was abreast of historical, philosophical and scientific thought. Since the 16th century both the reformed, or Protestant, and the Roman Churches have had to face this issue, presented by advances in civilization, and the former especially have attempted fresh interpretations. Modernism in the Roman Church has been stifled; neo-Thomism, which revives the system of Thomas Aquinas, is at present the popular and official line of apologetics. In other branches of the Church more attention has been paid to the historical and sociological implicates of Christianity, and the result has been a variety of interpretations, some of which stress the teaching of Jesus, others the mystical elements of the faith, and others again the sacramental.

Present Trends. The wider contact with other religions, especially those of the East, has also affected the outlook upon the meaning of Christianity in some quarters, producing either a healthy desire to dissociate Christianity from its Western and political associations, and on the other hand a tendency to resolve it into a syncretistic cosmopolitan system of brotherhood and theism. Two well-marked features of the present situation are these, the growing indifference to ecclesiastical factors and the accompanying tendency to accentuate the religious essentials of the faith. The former, however, encounters the fact that Christianity from the first has been connected with a Church. This idea of the Church as the Body of Christ, which differentiated it from the cults and Judaism alike, was characteristic of Christianity, and although organization has proved often too rigid and sometimes even a hindrance to the faith, yet fellowship and worship have been notes of the Christian community as it has lived and moved. A policy of some kind is needful. The pressing question to-day is to secure due recognition of the Church as spiritual and at the same time sufficient flexibility of social

and intellectual expression among those who call Jesus Lord. For it is upon the latter conviction that the former depends.

If there is one thing essential to Christianity, as revealed in its history, it is belief in Jesus as Living, as the Lord and Saviour. From time to time this or that element of such a faith is stressed. But the identity of the Church as Christian depends upon its worship of God as the Father of Jesus the Christ. What that involves is a matter for elucidation; but the core of it is the core of Christianity. "I speak of Christ and the Church," says the apostle. There is no ultimate value in speaking of Christ without speaking also of the Church as the Body of those who belong to Him and seek to face life not only as He faced it but in the spirit which He inspires, and this involves the sacraments as expressions of the unity and adoration implicit in such a fellowship. Behind all missions of the Church to the social and economic needs of men there must lie the breathing spirit of the Lord who in love for men revealed fellowship with God and man as permeated by love. All ethical applications, to be genuine, derive from the religious motives.

The task of the present day for Christians seems to be a double one, to prevent Christianity from being identified with any one type of ecclesiastical or doctrinal tradition, and on the other hand to prevent it from being evaporated into an easy-going attitude of fellowship without any definitely religious convictions. Only a fuller perception of the positive essence of the faith can avoid these perils. What that fuller perception may mean is best indicated by the untechnical words of Ruskin, better perhaps than by any statement of a professional scholar or religious philosopher. The total meaning of Christianity, he once wrote (*Praterita* ii. 207f), "was, and is, that the God who made earth and its creatures, took at a certain time upon the earth the flesh and form of man; in that flesh sustained the pain and died the death of the creature He had made; rose again after death into glorious human life, and when the date of the human race is ended, will return in visible human form, and render to every man according to his work. Christianity is the belief in, and the love of, God thus manifested. Anything less than this, the mere acceptance of the sayings of Christ, or assertion of any less than divine power in His Being, may be, for aught I know, enough for virtue, peace, and safety; but they do not make people Christians."

J. M.

CHRISTIAN PHILOSOPHY. Nowhere save in Christendom has religion found itself so estranged from the rest of culture as to require a special kind of philosophy, different from philosophy in general. Greek religion did not require a separate kind of philosophy. Religion was so integral a part of the culture that the same philosophy which sought to clarify basic concepts used in the lay aspects of life, endeavored to do so for religion. So likewise in Jewish, Mohammedan, Hindu and Chinese culture

there was no religious philosophy, except as philosophy in general was religious. In Christendom, however, there is a religious philosophy which can be called Christian, as distinguished from the rest of the philosophy of Christendom.

Why should the religion called Christian be so estranged from and maladjusted to the culture of its time and place as to develop a special kind of philosophy different from philosophy in general? There are two reasons for this; its adoption into an alien culture, and the rise of modern science. The history of this Christian Philosophy may be divided into three parts; from St. Paul to St. Augustine, from the Renaissance to the end of the 19th century, and from this date to the present. This last period is a time of gradual transformation of Christian philosophy into that branch of general philosophy called philosophy of religion.

Christianity was not indigenous to the culture where it appeared. It was taken over from Asia by western civilization; consequently for the first 300 years of its western existence it had to develop a special philosophy for purposes of offense, defense, mutual adjustment and interpretation. This philosophy began with the writings of Paul and John of the Fourth Gospel, and ended with St. Augustine. The latter practically completed the work of adjustment, interpretation, compromise and integration. From thenceforth until after Thomas Aquinas, the estrangement between western culture and its religion was healed. It could not be said that there was a special kind of philosophy called Christian, except as all philosophy of Christendom was Christian.

But, beginning with the Renaissance, the old estrangement between western culture and its religion again appeared. The culture of Greece and Rome was revived; and since it was not Christian there was conflict between it and Christianity. A little later science arose, with its distinctive method of inquiry, criticism and testing of belief. The scientific spirit began to demand that religious beliefs and practices, along with all other departments of life, meet the tests of scientific inquiry. Thus the Christian religion again found itself estranged and began to generate in self-defense a special kind of philosophy. When such philosophy becomes the mouthpiece of a single sect, as distinguished from Christianity in general, it is called theology. Certain forms of idealism, especially the personal idealism represented by Bowne and his followers in the United States, and by Sorley in England, are examples of Christian philosophy at the present time. They seek philosophical justification for the tenets of the Christian religion.

Beginning in the 19th century and becoming increasingly apparent in recent times, there have been indications of the development of a philosophy of religion which is not Christian, inasmuch as it does not try to defend and adjust traditional Christianity. Rather it seeks to discover what are the principles to which any religion must conform if it is to fulfill its needful functions, just as logic seeks to discover

what principles must be exemplified by any activity which would fulfil the function of thinking, or aesthetics seeks the normative principles of art, or ethics of conduct. Such a philosophy of religion does not try to find the elements common to all religions, any more than logic seeks to discover the elements common to all instances of thinking. The latter would be psychology, not logic; and the former would be a branch of anthropology or sociology, but not philosophy of religion. Philosophy of religion must needs be normative, not descriptive. It would be that branch of philosophy which seeks to explicate the basic principles of religion, and not an apologetic for Christianity. It would go to the great examples of religion for its data, just as logic must go to the great examples of thinking, but it would not be a distinct kind of philosophy, separate and antagonistic to the rest of philosophy. Harald Höffding, Leonard Trelawney Hobhouse, Hocking, ALFRED NORTH WHITEHEAD, Ames, Burt and Randall represent this movement.

If it be true that philosophy of religion is developing in the way indicated, the time may come when Christian philosophy will disappear. The newer philosophy of religion might well prize the Christian religion above others as an exemplification of religion, just as the logician may prize western science as the most instructive example of thinking. This preference of the western logician for western science may be merely a mark of prejudice and provincialism, as might also be the preference given to the Christian religion. But that is not necessarily the case. Some examples of thinking, like some examples of religion, come nearer than others to the norms which these require.

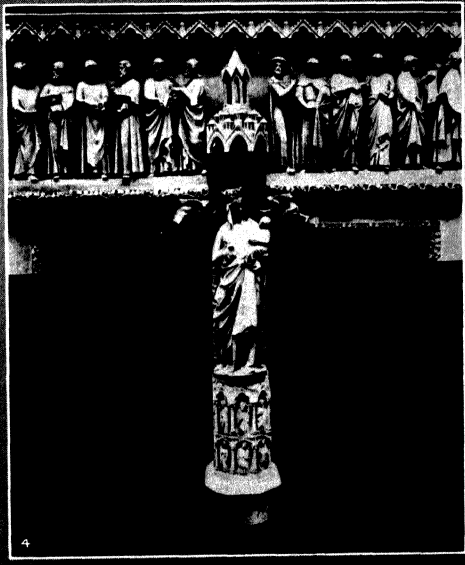
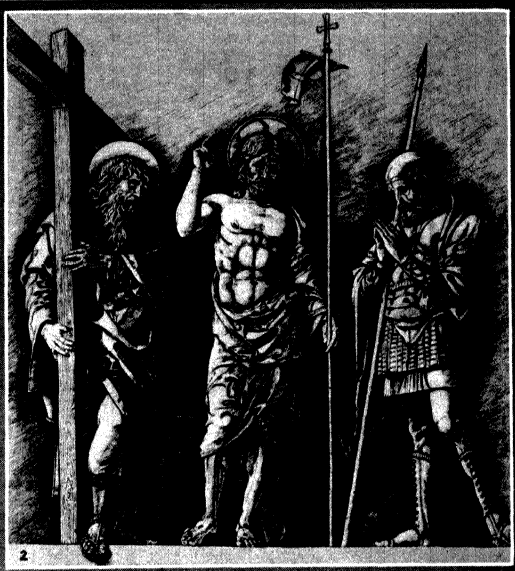
H. N. W.

BIBLIOGRAPHY—B. P. Bowne, *The Philosophy of Theism*, W. E. Hocking, *The Meaning of God in Human Experience*, W. P. Sorley, *Moral Values and the Idea of God*, A. E. Taylor, *The Religion of a Moralist*, A. N. Whitehead, *Religion in the Making*

CHRISTIAN SCIENCE, a system of metaphysical or spiritual healing discovered by MARY BAKER EDDY in 1866. The Church was established by Mrs. Eddy in Boston in 1879 and was given a charter by the Commonwealth of Massachusetts. In 1892 it was reorganized as a voluntary religious association known as the First Church of Christ, Scientist, in Boston, Mass., called more frequently by its adherents "The Mother Church." In 1875 Mrs. Eddy copyrighted the first edition of the textbook, *Science and Health with Key to the Scriptures*. By 1906 this book had reached 418 editions, since which time the publishers have ceased to number the editions. The Sunday services of the Church are conducted by First and Second Readers, the former reading from *Science and Health* and the latter from the Bible. In 1931 there were more than 10,000 practitioners of Christian Science in the United States and other countries, who devote their entire time to healing the sick through prayer.

A Board of Directors, consisting of five members, transacts the business of the Mother Church, defines its policies, and carries out the provisions of the

CHRISTIAN ART



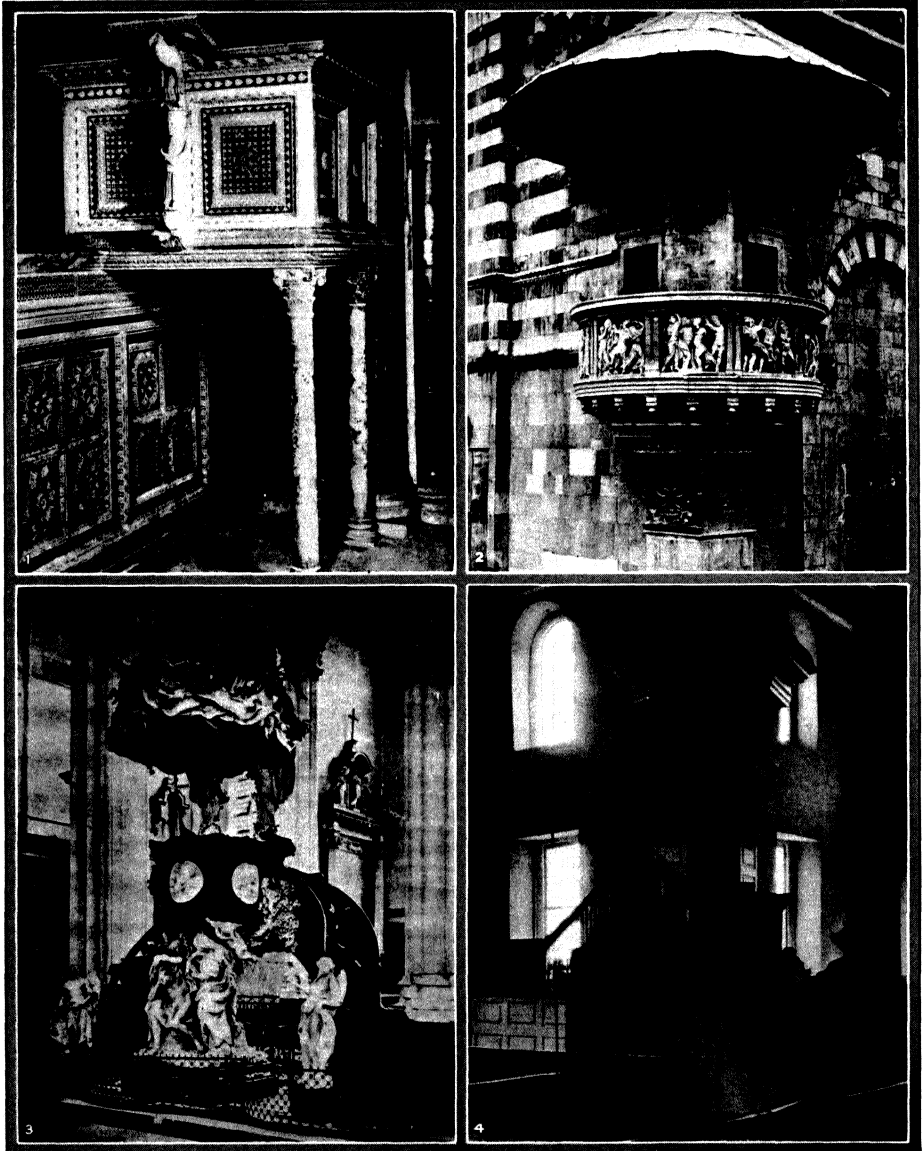
1. COURTESY CLEVELAND MUSEUM OF ART; 2. METROPOLITAN MUSEUM OF ART

REPRESENTATIONS OF CHRIST AND THE VIRGIN IN ART

1. Madonna and Child carved in ivory. Byzantine, 11th century. 2. "The Risen Christ Between St. Andrew and St. Longinus," an engraving by Andrea Mantegna (1431-1506). 3. Cartoon of St. Anne by Leonardo da Vinci

(1452-1519) for the painting, "Madonna, Child, and St. Anne," in the Louvre. 4. Virgin and Child ("la Vierge Dorée"), from the southern portal, Cathedral of Notre Dame, Amiens. 13th century.

CHRISTIAN ART



4. EWING GALLOWAY PHOTO

NOTABLE CHURCH PULPITS OF AMERICA AND EUROPE

1. Pulpit of incrustated marble work supported by columns, Church of San Miniato al Monte, Florence. 11th century. 2. Pulpit decorated by Donatello and Michelozzo on the outside of the Duomo of Prato, Italy. 15th century. 3. Pul-

pit by Laurent Delvaux in the Cathedral of St. Bavon, Ghent, Belgium, representing the Tree of Knowledge, with an allegory of Time and Truth. 1745. 4. "Three-decker" pulpit in Acquia Church, Stafford County, Virginia. 1664.

Manual. The annual meeting of the Church is held in Boston in June. During the fiscal year ending May 31, 1931, 79 new churches and Christian Science societies were recognized as branches of The Mother Church; 26 new organizations were located in Europe, one in Africa, one in Asia, four in Australasia, 45 in North America and two in South America. The total number of recognized branches, including 40 college and university organizations, was 2,559. Together with the Christian Science Publishing Society three departments conduct the important activities of the movement: the Board of Education, Board of Lectureship, and Committee on Publication. The educational board instructs and authorizes students to teach Christian Science. The Board of Lectureship, consisting in 1931 of 26 members, deliver free lectures on Christian Science throughout the world. During the year 3,732 lectures were delivered, of which 3,294 were in North America and 438 in foreign fields. The Committee on Publication is in charge of all public activities of the movement coming under the heading of public relations. The Christian Science Publishing Society, which publishes and issues the authorized literature of the Mother Church, operates under a deed of trust granted by Mrs. Eddy. Its affairs are administered by a board of trustees according to the Manual of the Church. The Publishing Society issues a daily paper, *The Christian Science Monitor*; *The Christian Science Journal*; *Christian Science Sentinel*; *Christian Science Quarterly*, and *The Herald of Christian Science* issued in French, German, English, Dutch, Scandinavian and Revised Braille editions respectively. The Church also conducts sanatoriums at Brookline, Mass., and San Francisco, Cal., and a home for Christian Scientists of advanced years at Concord, N.H. The headquarters of The Mother Church are in Boston, Mass.

The teachings of this religion are summed up in the following tenets, found on page 497 of the textbook, *Science and Health with Key to the Scriptures*, "1. As adherents of Truth, we take the inspired Word of the Bible as our sufficient guide to eternal Life. 2. We acknowledge and adore one supreme and infinite God. We acknowledge His Son, one Christ; the Holy Ghost or divine Comforter; and man in God's image and likeness. 3. We acknowledge God's forgiveness of sin in the destruction of sin and the spiritual understanding that casts out evil as unreal. But the belief in sin is punished so long as the belief lasts. 4. We acknowledge Jesus' atonement as the evidence of divine, efficacious Love, unfolding man's unity with God through Christ Jesus the Way-shower; and we acknowledge that man is saved through Christ, through Truth, Life, and Love as demonstrated by the Galilean Prophet in healing the sick and overcoming sin and death. 5. We acknowledge that the crucifixion of Jesus and his resurrection served to uplift faith to understand eternal Life, even the allness of Soul, Spirit, and the nothingness of matter. 6. And we solemnly promise to watch, and pray for that

Mind to be in us which was also in Christ Jesus; to do unto others as we would have them do unto us; and to be merciful, just, and pure." O. B. T.

BIBLIOGRAPHY.—Mary Baker Eddy, *Science and Health with Key to the Scriptures*, 1910-25; Walter S. Harris, *Christian Science and the Ordinary Man*, 1917; Sir William and Rosa M. Barrett, *The Religion of Health*, 1925.

CHRISTIANSAND. See KRISTIANSAND.

CHRISTIAN UNION, a denomination of Christian Churches which originated in Ohio in the early years of the Civil War, as a protest against political preaching; but was not fully organized until 1864. The principal leaders were four clergymen, Eli P. Farmer, J. F. Given, J. V. B. Flack and Ira Norris. The purpose of the Union was an effort to secure "larger liberty in religious thought, greater freedom from ecclesiastical domination and closer affiliation of men and women of different creeds." The doctrine of these churches is strongly evangelical, and each member "has the right to his own interpretation of Scripture." Their ministers are ordained by the annual councils, on the recommendation of the local bodies. The organization's total membership was 8,155 in 1926.

CHRISTINA (1626-89), Queen of Sweden, was born at Stockholm, Dec. 18, 1626. She was the daughter of Gustavus II. Adolphus, whom she succeeded, Nov. 16, 1632. Since she was only six years old, a regency was formed headed by the chancellor Axel Oxenstierna. In 1644 she took over the reins of government. She had been betrothed since childhood to her cousin, Charles Gustavus, but decided never to marry. In 1649 she secured the election of Charles Gustavus as her successor, and abdicated in his favor five years later. Shortly afterward she accepted the Roman Catholic faith, and later took up her residence in Rome, where she died, Apr. 19, 1689.

CHRISTMAS, the Christian religious festival or Mass celebrating the nativity of Christ, commonly observed annually by the Western churches on Dec. 25, and by the Eastern churches on Jan. 7. The date of the Western Christmas fell on a day which to the Romans was sacred as the *natalis invicti solis* of Mithraism and to the Angles of early Britain was *modra niht*, or mother's night, in connection with their druidism. Before the 5th century there was no common acknowledgment of Dec. 25 as the Christ mass, and there was no agreement on the date of Christ's birth. Even in the earliest mention of the day there is nothing to indicate that it was kept as a festival. In 1644 the Christmas observance was forbidden by Act of the English Parliament, but Charles II revived it at the Restoration, though the people of Scotland and some of the colonies of New England adhered to the Puritan rule not to observe the day. To-day it is commonly observed with religious services, greetings, gifts and hospitality, in the last of which the entire population, irrespective of religious affiliations, joins. Various folk-lore traditions give color to the celebrations in different European countries. See also NICHOLAS, ST.

CHRISTMAS-BERRY (*Heteromeles arbutifolia*), an elegant evergreen shrub or small tree of the rose family, also called tollon, toyon and California holly. It is native to the foothills and low mountains of California and Lower California and is often planted in mild climates as an ornamental. The many erect



FROM JEPSON MAN. FL. PLANTS CALIF. COPYRIGHT

CHRISTMAS-BERRY

Leaf, flowering branchlet, flower and fruit

branches, rising from a short thick trunk, bear handsome sharply toothed, shining, oblong leaves, large clusters of white flowers and persistent bright red fruit ripening in November or December. The fruit-covered branches, highly prized for Christmas decorations, are gathered in large quantities and sold in the markets like holly.

CHRISTMAS-FERN (*Polystichum acrostichoides*), a handsome evergreen fern of the holly-fern group. It grows abundantly in woods and on rocky hillsides from Nova Scotia to Wisconsin and southward to Florida and Texas. The narrowly lance-shaped, somewhat leathery leaves (fronds), borne on very chaffy leaf-stalks (stipes) and divided into many scythe-shaped, bristle-pointed leaflets, rise in a circular clump, 2 to 3 ft. high, from a stout, creeping root-stock.

CHRISTMAS ISLAND, a large low atoll in the Pacific Ocean in about 1° 57' N. lat. and 157° W. long. It forms part of the British Gilbert and Ellice Islands Colony, is about 100 mi. in circumference and affords good anchorage. It is said to have been discovered by Cook in 1777, and was occupied by Great Britain in 1888. In Jan. 1914 it was leased to the Central Pacific Coconut Plantations Ltd. for a period of 87 years. In 1927 there were but 23 inhabitants, five of which were European and the rest natives.

CHRISTMAS ISLAND, an island of the Indian Ocean in the Straits Settlements, lies 200 mi. south of Java and 500 mi. north of the Cocos Islands. It is 12 mi. long, has a width of five mi., and an area of

60 sq. mi. This island is important economically for large deposits of phosphate of lime, which form the chief export. The principal imports are machinery and apparatus for working the lime mines. The island is believed to have been discovered by the Dutch in the 17th century. It was formally occupied by England in 1888. In 1900 it was incorporated with the settlement of Singapore. Pop. 1928, 1,421.

CHRISTMAS PLAYS, plays or pageants usually symbolizing the meaning of Christmas, given at Christmas time. In the 17th and early 18th centuries Christmas pantomimes were given in the form of harlequinades. Since then the entertainments have largely taken on a religious character. Several plays are dramatizations of short stories, as *A Christmas Carol*, taken from Dickens's story of that name; *What Men Live By*, adapted from a story by Lióv Tolstóy; and *The Play of St. George*, acted by the English Dorsetshire mummies, based on the version in Thomas Hardy's *Return of the Native*. Of modern Christmas plays, there are *Jolly Plays for Holidays* by Carolyn Wells, 1914, *The Evergreen Tree* by Percy Mackaye, and *The Saint of Sussex* by Sheila Kaye-Smith, 1927.

CHRIST OF THE ANDES, a monument erected on the summit of La Cumbre, over 12,000 ft. above sea level, on the boundary line between Argentina and Chile. Its position commemorates the treaty made between the two republics in 1903. It consists of an octagonal granite column 22 ft. high upon which is a hemisphere of granite with a partial sketch of the world's outlines. On this stands a bronze figure of Christ cast from old Argentine cannon, 26 ft. high, the cross extending 5 ft. above. Two bronze tablets on the granite base bear inscriptions in Spanish, on one side statistics and dates, on the other:

Sooner shall these mountains crumble into dust than the people of Argentina and Chile break the peace which they have sworn to maintain at the feet of Christ, the Redeemer.

The dedication ceremonies took place in Mar. 1904 in the presence of hundreds who had climbed the mountain.

CHRISTOPHE, HENRI (1767-1820), King of Haiti, was born in the English Antilles in 1767. He purchased his freedom from serfdom and was one of the leaders in the uprising of the Negroes, 1803. Christophe became general in chief, then president of northern Haiti, and in 1812 was proclaimed King. His tyrannical rule led to a revolt and, forsaken by his troops, he committed suicide, Oct. 8, 1820.

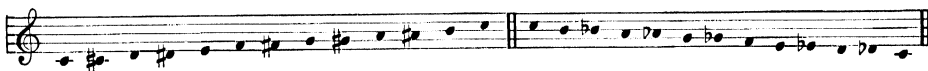
CHRISTOPHER, ST. (died c. 250), martyr and patron saint of all travelers, was born a pagan in Syria, and is said to have been of unusual height and strength. He served the new Christian religion by carrying pilgrims on his back across a certain stream. Legend states that he thus carried the Christ in the form of a child, who revealed to him that the burden was heavy because it bore the sins of the whole world. He was martyred under Decius about 250.

CHRIST'S THORN (*Paliurus Spina-Christi*), called also Jerusalem-thorn, a spreading shrub or small tree of the buckthorn family, native from southern Europe to northern China and sometimes planted for



ST. CHRISTOPHER AND THE CHILD JESUS
From an engraving by Albrecht Dürer

ornament in mild climates. Each small, smooth, dark green leaf bears at its base two spines, one straight and the other curved into a hook.



CHROMATES AND DICHROMATES, salts of chromic acid. They are generally prepared by heating the mineral chromite, a mixed oxide of chromium and iron, with lime and potash, in the presence of air or oxygen. The resulting mass is dissolved in hot water, and the calcium precipitated by potassium sulphate, which leaves potassium chromate (K_2CrO_4) in solution. This is either crystallized out as a bright yellow substance, or, by the addition of acid, converted into potassium dichromate, of formula $K_2Cr_2O_7$, now a deep orange-red in color. The potassium salts are generally employed to prepare all other chromates.

The use of chromates and dichromates depends, on the one hand, upon their brilliant yellow and orange-red coloring, which renders them valuable as paints and pigments, and on the other hand, upon their ability to act as oxidizers. Among the former applications are those of chrome yellow or lead chromate, and lemon chrome or barium chromate; among the latter falls the use of potassium dichromate in tanning leather, as a solution in galvanic batteries, as a bleaching agent for oils and fats, and in photography because, acting in the presence of light, it has the ability to make gelatine insoluble in water.

CHROMATIC ABERRATION, a term used to describe the fact that a LENS has a different focal

length for LIGHT of a different WAVE-LENGTH or index of REFRACTION. This gives rise to a plurality of images of a given source for the different wave-lengths or COLORS which are not completely superposed, and so yields color effects around the image. Thus, an image obtained with such a lens will be surrounded by a fringe of red light or of blue light. Chromatic aberration may be largely eliminated by combinations of lenses made of glasses with different dispersive powers. By a combination of two such lenses, complete correction can be made for two points in the spectrum, and a large reduction of aberration can be made in other parts. By combination of a larger number of lenses of different kinds of glass, further correction may be made, but, as other defects usually arise, it is not common to correct for more than two points in the spectrum. Mirrors do not show chromatic aberration since they reflect all wave-lengths in the same way. See also ABERRATION IN OPTICAL SYSTEMS.

P. I. W.
BIBLIOGRAPHY.—R. A. Houstoun, *Treatise on Light*, 1927.

CHROMATIC SCALE, as opposed to the DIATONIC SCALE, is a series of minimum musical intervals. In equal TEMPERAMENT the chromatic scale is a division of the octave into twelve exactly equal intervals; in the so-called pure scale of JUST INTONATION, the number of tones, and therefore of intervals, is actually endless but, save on paper, has never been carried out farther than 53 separate tones to the octave. The ordinary notation of the chromatic scale is as follows:

CHROMATOMETER or **TINTOMETER**, an instrument used to obtain the intensity and hue of a given COLOR by matching it with light from a standard source which has passed through one or more filters. Usually, red, green and blue filters are used simultaneously, the light passing through them in succession. In order to get a match, it is necessary to have available not only one filter of each color but a whole series of various depths of color, so that a complete set comprises over 400 filters. The color match is given by the depth of color of each of the three filters. Filters of glass are customary, although liquid filters may also be used. See also COLORIMETER.

T. S.

CHROMITE, the only commercial ORE of chromium, known also as chrome iron ore, consisting of iron chromate. It is a common constituent of the basic IGNEOUS ROCKS, such as GABBROS, PERIDOTITES, PYROXENITES, and the SERPENTINES into which they alter. Grains of chromite may be scattered through them or may occur in streaks and masses. Chromite is black and metallic in appearance, and is sometimes found in small octahedral crystals. It is used in the manufacture of refractory bricks, and chromium salts are used in making certain paints and chemicals, and in printing, dyeing and tanning. Chromium is used for

hardening steels and for plating other metals to produce a hard, non-tarnishing surface.

The United States produces almost no chromium, although chromite is found in the Appalachian, Rocky and Coast Range mountains, but the nation uses about 60% of the world's production which comes chiefly from Rhodesia, Turkey, Greece and New Caledonia. *See also* ORE DEPOSITS.

CHROMIUM, a metallic element of the sixth group (symbol, Cr), sp. gr., 6.92; at. wt., 52.01; melting at 1615°C. and boiling at 2200°C. It is harder than ordinary steel, is brittle, and can take a mirror polish. Chemically, chromium is amphoteric, forming chromium salts in which its valence is usually 3 (sometimes 2), and chromates in which its valence is usually 6. All compounds of chromium are colored, a property from which it derives its name. Chromium is soluble in hydrochloric and sulphuric acids, but not in nitric acid, in which it becomes passive. It resists ordinary atmospheric action rather well.

The principal use for chromium is in alloy steels, including the new stainless steels, and similar corrosion- and chemically-resistant ferrous alloys. It has recently come into extensive use as a brilliant metal finish, being applied by ELECTROPLATING from a solution of chromic acid. Compounds of chromium are used extensively as pigments for paints and ceramics, in leather tanning, and in dyeing. *See also* CHROMIUM STEELS; CHEMICAL PLANT EQUIPMENT; ELECTROPLATING. L. R. W.

CHROMIUM PLATING when applied for decorative purposes has a brilliant bluish-white luster similar to polished platinum. CHROMIUM is attacked readily by HYDROCHLORIC ACID, by SULPHURIC ACID with difficulty, but withstands almost all other acids and alkalis very well.

One outstanding characteristic is its resistance to tarnish in the atmosphere. Because of this property, chrome-plate finds application on automobile fittings, plumbing fixtures, household appliances, and jewelry. In thicknesses of only 0.0001-0.0003 in. over ordinary copper and nickel plates the corrosion resistance of the object is increased about three-fold. Commercial chromium plate on steel or brass without undercoatings of nickel or copper is of little value because the plate is porous.

Another characteristic of electro-deposited chromium is its great hardness and low coefficient of friction. For this reason it is applied in thicknesses of 0.0005-0.004 in. to the working surfaces of gages, printing plates, shafts, dies and mandrels, and other articles which are to resist wear. Its hardness on the Brinell and Mohs scales is 650 and 8, respectively, in contrast to 125 and 3.5, respectively, for ordinary cast chromium. Plated chromium loses its hardness upon heating to 300°C. At 500°C. it begins to oxidize.

Chromium is deposited commercially from a bath containing approximately 250 grams per liter of chromic acid and 2.5 grams per liter of sulphuric acid. At 45°C. a current density of 10 amperes per square decimeter is used; at 60°C. 25 amperes per

square decimeter. The anodes are usually of lead. Good chromium plating practice depends upon careful maintenance of correct and identical conditions in the following four essentials: (1) temperature of the bath, (2) current density, (3) condition and nature of the surface of the work, (4) composition of the plating bath. R. S.

CHROMIUM STEELS, are classified into two groups depending on whether the CHROMIUM addition is made primarily for increasing the strength, or for improving the corrosion resistance. In the first group, chromium may be present in amounts up to 8%, while in the second, the amount present is 11% or greater.

The chief characteristics of the steels of the first group, and the properties upon which their uses depend, are their high strength and hardness. Chromium when present in the amount usually found in these steels exists largely as chromium carbide and it is because of the presence of the extremely hard carbide particles that the steels possess their great strength and hardness, and their relatively low ductility. The chief uses of these steels are for drill rod, saw blades, files, ball and roller bearings, and miscellaneous tools. Their ductility can be improved by the addition of nickel in amounts up to 5%.

The chromium steels of the second group, the so-called *stainless steels*, may be divided into four groups: (1) stainless steel—carbon over 0.20%, chromium 12-14%, (2) mild stainless steel—carbon under 0.12%, chromium 12-14%, (3) stainless iron—carbon under 0.12%, chromium over 16%, (4) austenitic stainless iron—carbon under 0.12%, sufficient chromium and nickel to render the steel austenitic on air cooling.

The stainless steels were the first developed and are largely used for making cutlery. They are only stainless in the quenched condition and for this reason, as well as because of the difficulties in their mechanical working, their field of usefulness is rather limited.

The mild stainless steels differ from the preceding group only in that the carbon content is lower. The decreased carbon content greatly alters the properties, however, for these steels are stainless in the annealed or soft condition. This is explained on the assumption that so little chromium is required to combine with the carbon to form carbides, that sufficient remains to dissolve in the iron to render it stainless. These steels are largely used for turbines, blades and for chemical equipment. Their field of applications is limited because of their air-hardening characteristics.

The stainless irons (*see* IRON) differ from the mild stainless steels in that they contain greater amounts of chromium. They are stainless in the softened or annealed state and are not capable of being hardened by heat treatment. They were originally widely used for tubes for boilers, stills, and superheaters but because of their marked susceptibility to grain growth at temperatures above 1650°F., and because of their embrittlement at 850-1000°F., their use for these pur-

poses has been discontinued. They are now used in chemical equipment, especially for that which comes in contact with nitric acid. (See also ALLOYS, HIGH TEMPERATURE.)

The austenitic stainless irons differ from the preceding in that they contain appreciable amounts of nickel, generally 8-10%, and consist of gamma, rather than alpha iron. These alloys are the most extensively applied of any of the stainless steels and are used in tubes for stills and superheaters, for chemical equipment, and for automobile parts. The only factor which tends to limit their use is their relatively high cost. (See also AUSTENITIC STEELS.) C. L. C.

CHROMIZING. See METAL COATINGS.

CHROMOLITHOGRAPHY. See LITHOGRAPHY.

CHROMOSOME, one of the deeply staining bodies that appear in the nucleus at the beginning of cell division. They have prevalingly an elongated or sausage shape, though in many cases they are minute spherical particles. The name is applied to them because they become deeply stained by the dyes used in microscopy. The number of chromosomes is usually constant for a species. Each chromosome has its individuality and is made up of a series of genes each of which plays its particular rôle in development. The colored material of the nucleus is the so-called chromatin, which is widely diffused in the resting nucleus, but concentrates in the chromosomes during division.

Just before the maturation division of the germ cells in which the number of chromosomes in the cells is reduced from n pairs to n singles the chromosomes arrange themselves in pairs. Each individual chromosome derived from the egg, that initiated the now matured individual, unites with its homologue which was brought in by the sperm. Thus the homologous chromosomes of paternal and maternal origin come to lie next to each other in pairs with corresponding poles in juxtaposition. In the cell division which follows one of each pair of these chromosomes passes to one of the daughter cells, the other to the other daughter cell. Apparently it is ordinarily altogether accidental whether a particular daughter cell will receive the paternal or maternal component of any chromosome.

The chromosomal complex, though ordinarily constant, is subject to some irregularities, which may be in number of chromosomes or in the genes that constitute the chromosomes. An additional chromosome may get into the complex that does not belong there but may, thereafter, remain associated with it. The chromosomes may all be doubled in number, or they may fragment. Pieces of non-homologous chromosomes may become attached to each other more or less permanently. Through such attachments the constitution of a chromosome becomes altered and so does its relation with other chromosomes in the complex. The nature of the attractions and repulsions exhibited by homologous and non-homologous chromosomes has not yet been discovered. If the chromosome-complex becomes modified in any of these

ways the development of the individual is modified accordingly.

The chromosome is thus believed to be an agent for ensuring an orderly distribution of the genes to the different cells of the body and to the germ cells that are being prepared for the next generation. It is by virtue of the linear arrangement of the genes in the chromosomes and the orderly division of the chromosomes that the different germ cells secure their complete complement of genes and are thus able to carry on the hereditary characters from generation to generation. C. B. D.

CHROMOSPHERE, one of the layers in the sun's atmosphere, visible only during an eclipse.

CHRONICLE PLAY, a dramatization in PROSE and BLANK VERSE of historical events, usually those which are national in character. This form of play, known as a chronicle history, arose toward the end of the 16th century. Three plays are known which deal with the reign of Richard II: *The Life and Death of Jack Straw*, published 1594; *A Tragedy of King Richard II*, sometimes called *Woodstock*, probably 1591-92; and Shakespeare's *Richard II*, probably 1595-97. Others of the same type are *The Famous Victories of Henry V*, acted before 1588; *The Tragedy of Sir Thomas More*, about 1590; *The Troublesome Raigne of King John*, 1591, and Marlowe's *Edward II*, 1590. Broadly speaking, the term chronicle play should also include those known merely as historical plays, as Shakespeare's *Richard III* and *Henry VIII*. See also ENGLISH DRAMA.

BIBLIOGRAPHY.—C. Dibdin, *A Complete History of the English Stage*, 1800; F. E. Schelling, *The English Chronicle Play*, 1902. *The Cambridge History of English Literature*, 1907-17.

CHRONICLES, BOOKS OF, in the Old Testament, were originally one book, the division having been first made in the Greek or Septuagint version. The name *Chronica* appears first in the Vulgate, but in the Douay version to-day they are called I and II Paralipomenon. In the Hebrew the title means diaries, and in the Greek, omitted things. Many modern scholars believe the contents to be traditions and records collected first by Ezra, and revised and edited about the 4th century B.C. Internal evidence is educed by them to support an authorship after the days of Alexander the Great, about 300 B.C. The commonly accepted belief, however, is that the records are much older. Although the 65 chapters of the two books are heavy with minor matters and genealogies, they are by no means barren of vivid passages illustrating the place which God occupied in the wars and national life of the people, as for instance, "Be of good courage and let us play the man for our people;" and "With him is an arm of flesh, but with us is Jehovah our God." They bring the story down to the days of Cyrus, King of Persia.

CHRONOGRAPH, an instrument for measuring and recording intervals of time. The simplest type of chronograph comprises a WATCH with a hand which makes a revolution per minute by steps of $1/5$

sec. This instrument is set at zero by pressing a key, is started by pressing the key again and is stopped by pressing the key a third time. For scientific work, where great accuracy is required, chronographs are so constructed that a standard Clock serves as the timing apparatus. In general, these comprise a mechanism for moving a strip or cylinder of paper at a uniform rate and pens, or other marking instruments, controlled by ELECTRO-MAGNETS. The magnets, with their pens, are operated by electrical impulses sent out each second by the standard clock and by a signal key operated at the beginning and the end of the timing period. One type of chronograph prints the time in minutes, seconds and hundredths of seconds. In a type of astronomical chronograph, the trail of a star is photographed directly with the hair lines of the TELESCOPE on a photographic plate, time intervals being recorded by giving the plate a slight north and south displacement each second.

CHRONOMETER, a timekeeper used at sea for determining longitude; originally, any time-keeping instrument. The chronometer is the same as the ordinary WATCH, with certain differences in mechanical construction which make for greater accuracy. It employs a helical balance spring and a spring-detent, or chronometer, escapement instead of the spiral balance spring and lever escapement used in the watch. The whole instrument is suspended in gimbals to render it independent of the motion of the ship. Chronometers are ordinarily accurate within a second per day.

CHRYSANthemum, in botany, the name of a large genus of plants belonging to the sunflower family, comprising about 150 species among which are the feverfew, corn marigold, marguerite, costmary, ox-eye, and giant daisy. Popularly, however, the name is applied to the important group of mainly hardy, herbaceous perennials and subshrubs with typically white or yellow flowers, the chrysanthemums of the florists.

The countless florists' varieties have been derived through selective breeding and hybridization of a cultigen (*C. morifolium*), probably of Chinese origin. They now constitute a horticultural group (sometimes designated *C. hortorum*) of such importance that more than 100 books together with innumerable articles in periodicals constitute a literature of the chrysanthemum scarcely less voluminous than that of the rose.

What the rose is to Europe and America the chrysanthemum is to the Orient. In America, from both the garden and the commercial standpoint, it is the most important autumn-blooming flower, especially during the Thanksgiving season. Florists' varieties are generally called large flowered to distinguish them from the usually smaller outdoor hardy kinds which differ mainly in being hardier and less highly developed in size.

For convenience of classification the varieties have been grouped by the National Chrysanthemum So-

ciety of England in about a dozen types, of which the most important are: Single, large and small; Anemone, large, small and Japanese; Pompon; Hair; Ostrich Plume or Japanese Hair; Miscellaneous. From the commercial and exhibition standpoints the large flowered varieties, especially in pure yellow and pure white, are the most popular for individual blooms, one flower to a stem, but the single anemone-flowered kinds are most desired as potted plants bearing many flowers, though other types, particularly the pompons, are also grown in the same way. The pompons, especially the yellow and brown varieties, are highly prized as outdoor plants.

As garden plants chrysanthemums demand no special treatment. The annual varieties grow readily from seed; the perennials from suckers and cuttings, preferably taken after the plants have bloomed or in the greenhouse during early winter and rooted in sand. The pompon varieties are hardier than the large-flowered kinds. M. G. K.

CHRYSEIS, in Greek mythology, the daughter of Chryses, a priest of APOLLO. During the siege of Troy she was abducted by AGAMEMNON, in punishment for which Apollo sent a pestilence upon the Greeks. CALCHAS, the seer, disclosed the cause of the pestilence, and Agamemnon was obliged to give her up. He demanded, however, that he should be given BRISEIS, the slave of Achilles, in return. This was the cause of the famous quarrel between the two heroes.

CHRYSLER BUILDING, a 77-story, brick office building, with 70 floors of office space, is located in New York City on Lexington Ave. and 42nd St. When formally opened April 1, 1930, it was the tallest structure in the world, rising 1,046 ft. from the sidewalk. The foundation is sunk 69 ft. below the street in bed rock; the ground plot comprises 37,555 sq. ft.; the volume is 14,300,000 cu. ft., with 1,000,000 sq. ft. of floor space.

The setback principle is used and the whole resembles 5 buildings, placed one on top of the other, surmounted by a seven-arched dome and a pointed finial 185 ft. high. A silvery metal, nirosta, which will not rust is used for the finial and other decorative features such as eagles and gargoyles. Fine marble from Europe, Africa, and the United States are used in the interior. A mural by Edward Trumbull, fitting into a triangular design is on the ceiling of the lobby. William Van Alen was the architect and Walter P. Chrysler the builder. An observation tower is open to the public.

CHRYSOBERYL, a gem stone which is ordinarily green, yellow or colorless. The emerald-green variety, which is red by artificial light, is known as ALEXANDRITE. The type showing a chatoyant effect is called CAT'S-EYE. In composition, chrysoberyl is a beryllium aluminate crystallizing in the ORTHORHOMBIC SYSTEM. The color is due to impurities, chromium conferring an emerald green color and iron a pale green hue. The name is derived from two Greek words, meaning golden and beryl. Cymophane, from the Greek, refers to a variety which exhibits a peculiar

opalescence. Chrysoberyl is found in Brazil and Ceylon as water-rolled pebbles in river deposits. In the Ural Mountains it is found in mica SLATES, and in the United States in Connecticut, New York, New Hampshire and Maine, where it occurs in GRANITES. It is readily made artificially.

The natives of Ceylon use the cat's-eye as a charm against evil spirits, and Alexandrite is considered a stone of good omen in Russia. *See also* GEM STONES.

CHRYSLITE, called also OLIVINE and Job's Tears, a rock-forming silicate of frequent occurrence as a minor constituent in basic igneous rocks, such as BASALT and GABBRO and certain LAVAS and METEORITES. It occurs in dark yellowish-green to olive or bottle-green grains and masses, or in orthorhombic crystals. Chrysolite is an iron magnesium silicate. When transparent and of a pale yellowish-green color it is known as the semiprecious PERIDOT or evening emerald. *See also* GEM STONES.

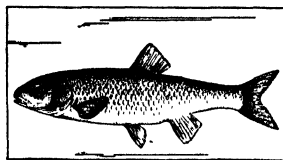
CHRYSOPRASE, an apple-green variety of silica which is classed as a semiprecious stone. It is cryptocrystalline, showing no crystal structure except under the microscope, thus being a form of CHALCEDONY. The green color is due to the presence of small amounts of nickel oxide as an impurity. Like other forms of chalcedony, it has a waxy luster and is transparent to translucent, occurring in mammillary and stalactitic forms, and as cavity linings in rocks. Chrysoprase is found frequently in Silesia. The modern chrysoprase is not the *chrysoprasus* of the ancients, which was the BERYL of the present day. Chrysoprase earth has no relation to this form of chalcedony, but is an earthy nickel silicate. *See also* GEM STONES.

CHRYSTOM, ST. JOHN (c. 347-407), an eloquent Father of the early Greek Church, was born at Antioch, Syria, about 347, and died at Comana, Cappadocia, on Sept. 4, 407. He was taught rhetoric by Libanius, a Greek Sophist, who would have made him his assistant had not St. Chrysostom's religious plans interfered. His eloquence won him the name of "the Golden Mouth," a title which before had been given only to the eminent Sophist, Dio Cocceianus. At Antioch he was made a preacher and prelate and he later became Patriarch of Constantinople. He is commemorated by the Greek Church on Jan. 27 and Nov. 13, and by the Latin Church on Jan. 27.

CHUB, the name of several fishes belonging to the carp family (*Cyprinidae*). In the rivers of England and western Europe, the chub (*Leuciscus cephalus*) attains a length of from 2 to 6 ft. and weighs from 5 to 12 lbs. Its coloring is blue-black above becoming silvery beneath. The river chub (*Hypopus kentuckiensis*), about 10 in. long, is found in the eastern part of the United States and is so plentiful and easy to catch that it is called a "boy's fish." It is distinguished by its deep yellow fins, common to all chubs, and the appearance of tubercles on the heads of the males in the spring spawning season. The creek chub (*Semotilus atromaculatus*) also known as horned dace, is abundant in the brooks of the eastern and western parts of the United States. Its small size

of from 3 to 12 in. makes it a good bait fish. Another chub (*Mylocheilus lateralis*) inhabits the Columbia River.

In 1929 the commercial catch of chubs in United States waters, taken exclusively in the Great Lakes



CREEK CHUB OR HORNED DACE

region, amounted to 5,601,000 lbs. with a value of \$589,000.

CHUCKS, devices usually provided with three or four converging jaws for gripping work or tools in machining operations. They vary from very small chucks that hold the smallest drills to huge mechanisms that hold very large work in LATHES or boring mills. Designs and mechanisms vary widely. Most chucks are operated by hand but some use Compressed Air or small electric motors to close the gripping jaws on the work.

Some types of chucks are known as "collets," these being used for holding finished or partly finished surfaces. In others the jaws move simultaneously to or from the center, while in still others each jaw can be moved separately; some permit either type of movement. Work is also held in special devices known as JIGS and FIXTURES, but these bear little relation to chucks used in regular work.

CHUCK-WILL'S-WIDOW (*Antrostomus carolinensis*), a species of whippoorwill breeding in the southern United States and wintering southward to the Greater Antilles and Colombia. It is about a foot long, with streaked and mottled plumage and a fringe of long stiff bristles at the base of the bill. In habit it is nocturnal, frequenting dense brush and thickets by day. It feeds chiefly upon insects, though it has been known to swallow humming birds and sparrows, when attracted to lights on migration. Usually the two spotted, whitish eggs are laid on the bare ground. The call of this bird resembles the words "chuck-will's-widow" repeated rapidly.

CHUFA (*Cyperus esculentus*), called also earth-almond and rush-nut, a species of galangale native to warm temperate regions and cultivated to a limited extent as a food plant. It is a stout, sedgelike perennial, about 2 ft. high, producing oblong edible tubers (chufas). In the southeastern United States, especially in Georgia, this plant is grown on a commercial scale, with a yearly production exceeding 200,000 bushels. The plant is also very widely distributed as a weed, sometimes becoming pestiferous.

CHUMASHAN, a North American Indian linguistic stock. The people speaking its dialects occupied the southern California coast. These groups

are also known as Santa Barbara. The stock has been classified into seven dialects: San Luis Obispo, Purisima, Santa Inez, Santa Barbara and San Buenaventura missions, and Santa Cruz and Santa Rosa islands. The language shows some resemblance to SHOSHONEAN and SALINAN. In 1542 the Chumash were in contact with the Spaniards who established Franciscan missions among them. Their relations continued amicable until early in the 19th century when the Indians revolted. Throughout the mission period the population gradually decreased so that the Chumash are now practically extinct or entirely Mexicanised. In marked contrast to other California Indians they usually had an abundant supply of food, depending on the products of the sea rather than vegetal produce. They lived in villages of communal houses of grass or tule, made plank canoes which are otherwise unknown in the area, and carved wooden dishes and grave figures, made objects of shell and wove fine baskets. Their religious and social organization are not well known. The family was the basic unit of organization and the village the political unit.

CHUMAWAI, an American Indian band or village in Big Valley, Modoc co., Calif., related to the Athapaskan ACHOMAWAI.

CHUNGKING, chief commercial port of western China and capital of the mountainous province of Szechwan. The city, enclosed in a wall, is built on a high bluff, standing at the meeting of the Chia-ling River with the Yangtze-Kiang about 1,400 mi. from the mouth of the latter. Chungking has a modern electricity plant. Its exports are silk, goatskin, hides, bristles, as well as musk, rhubarb and wool brought through the border of Tibet. An additional article of the Chefoo Agreement opened Chungking to foreign trade in 1890. The first steamer to reach the city went up the Yangtze in 1898. British gunboats arrived in 1899, the same year that the merchant steamers docked. Rebellions and civil disorders have interfered with the city's development. Pop. 1930, 622,000.

CHUR, a city of Switzerland, capital of the canton of Graubünden on a tributary of the Rhine. In the higher part of the city is the court, the episcopal residence with the ancient Romanesque cathedral. Connected with the bishop's palace is a Roman tower containing a library and archives including documents from Charles the Great. There is a priests' seminary in a former abbey, a museum and a library. There is little industry, but considerable tourist traffic. Chur was mentioned about 451 as the seat of a bishop. Pop. 1930, 15,578.

CHURCH, FRREDICK EDWIN (1826-1900), American landscape painter, was born at Hartford, Conn., May 4, 1826. A pupil of Thomas Cole from 1844-48, he developed an excellent technique, especially in the representation of clouds and rock masses. Church won contemporary acclaim with such imposing canvases as *The Heart of the Andes*; *The Great Fall at Niagara*, now in the Corcoran Gallery; and *Cotopaxi*, now in the New York Public Library. More truly successful from an artistic point of view

were *The Parthenon* and *The Aegean Sea*. The latter is now in the Metropolitan. Church died near New York City, Apr. 7, 1900.

CHURCH, as the word is used in the English language, a term signifying a building for religious worship or the collective body of worshippers holding the same creed. It can also be used to denote the clerical profession, as when one speaks of "going into the church," or it can mean a church service, as when one says "attend church." When used in the phrase "Church and State" it refers to the collective body of all Christian churches. In England and in Scotland it specifically refers to the Episcopal and Presbyterian churches, all others being known as chapels or meeting houses. In the United States and elsewhere, it shares with temple and tabernacle the right to stand for the house of worship of any denomination. The Greek word *ecclesia*, which the New Testament translates as church, was the regular designation of the assembly of the whole body of citizens, in a free Greek State, "called out" or summoned to transact public business. The Septuagint uses the word to translate the Hebrew term, congregation of Israel, meaning the people of God as a whole, which usage determined the early Christian conception. In the only two places in the Gospels (Matthew 16:18; 18:17) where the word occurs, it is used in this sense.

CHURCH AND STATE, the question of the proper relationship between State and Church, has at one time or another agitated the internal politics of almost every country in western Europe. Historically, a particular religious sect, originally the Roman Catholic but after the Reformation frequently Protestant, has usually occupied a favored position. This position has varied from that of a state church with the exclusive right to hold all the religious services within the country to that of an institution merely supported at public expense. As early as the 16th century, however, there arose out of the tangled skein of the Reformation a movement for the separation of State and Church which, although it did not gather force immediately, has in the course of centuries swept the larger portion of the world. Except for the fact that ecclesiastical institutions are still tax exempt, the last vestige of a state supported church was swept from the United States in 1834. Since that time, the principle of the separation of Church and State in the United States has been almost as sacred a principle of political organization as the principle of representative government itself.

CHURCHES OF CHRIST, a religious body resulting from a cleavage in the DISCIPLES OF CHRIST. The application of the slogan, "restoration of primitive Christianity," which from their beginnings occupied a large place in the thoughts of the Disciples, was strictly construed by many who believed that fidelity to the primitive pattern of the Church excluded the organization of missionary societies, and that, since "the elements of public worship are prescribed, both inclusively and exclusively," the use of

musical instruments in the Church is inadmissible. There were other issues, such as the employment of pastors, or the one-man system, but the most acute was the missionary society question. It should be noted that the strict constructionists were not anti-missionary, but anti-society. The practical separation of this group from the larger body of Disciples became clearly marked after about 1870 through its abstention from all organized activities, its refusal to employ ministers who countenanced the organ, and its patronage of only those religious papers which upheld its views on these points. In the religious census of 1906 it first attained statistical independence under the name Churches of Christ. By the census of 1926 the Churches of Christ had 433,714 members, chiefly in the southern states and in the southern part of Indiana and Illinois. Of the total number, about one-fourth were in Texas and another fourth in Arkansas and Tennessee. They maintain several colleges and a number of foreign missionary stations. W. E. G.

CHURCHES OF GOD, sometimes called the General Assembly of the Churches of God, is the name of a religious body in the United States organized first under the name of the CHRISTIAN UNION in Tennessee in 1886. In 1902 it was reorganized under the name of the Holiness Church, and the present name was the result of a second reorganization in 1907. To-day these churches are to be found chiefly in Tennessee, Florida, Georgia, Alabama, Virginia, and in the West Indies. In doctrine the churches are Arminian and approximate the general beliefs of the Methodists. Conditions of membership include the experience of being "born again." The policy combines the congregational and the episcopal forms. The pastor is head of the local church, and the officers of the body are bishops, deacons and evangelists. A General Assembly, composed of representatives from all states, meets annually. In 1926 the Churches of God had a membership of 2,278.

CHURCHILL, WINSTON (1871-), American novelist, was born in St. Louis, Mo., Nov. 10, 1871. He was educated in the public schools of St. Louis and at the United States Naval Academy, from which he was graduated in 1894. His first novel, *The Celebrity*, was published in 1898, followed in 1899 by his first great success, *Richard Carvel*, a story of Maryland during the Revolution. In 1901 *The Crisis* appeared, with a descendant of Richard Carvel for its heroine. From 1903 to 1905 Churchill served as a member of the New Hampshire legislature, where he had taken up his residence, and in 1906 worked for various reforms through the Republican National Convention. In 1912 he ran for governor on the Progressive ticket. Though giving much time to painting and lecturing, he continued writing his novels of historical and contemporary American life. *Coniston*, considered by many his best work, was published in 1906, *The Inside of the Cup*, 1913, *A Far Country*, 1915, *The Dwelling Place of Light*, 1917.

In 1918 was published *A Traveller in War Time*, and in 1919, *Dr. Jonathan*, a play.

CHURCHILL, WINSTON LEONARD SPENCER (1874-), English statesman, was born at London on Nov. 30, 1874, son of Lord Randolph Churchill. He received his education at Harrow and Sandhurst. He then obtained a commission in the army, and fought with his regiment in expeditionary forces in India and Africa. During the Boer War, 1899-1902, he acted as correspondent for *The Morning Post*. Out of his army experience came *The River War*, 1899. In 1900 he entered the House of Commons, beginning a long and active career in British politics. Although at first a Conservative, he altered his viewpoint, and by 1909 had attained a position of prominence in the Liberal party. In 1910-11 he was home secretary, and in 1911, when Asquith sensed an approaching conflict with Germany, Churchill became first lord of the Admiralty, his instructions being that the fleet should be prepared at all times to resist an attack by Germany. While in the Admiralty office he carried through many reforms and improvements in the British navy, and participated in the laying of plans of war campaigns. (See WORLD WAR.) He left the Admiralty in 1915 when the Liberal government fell, and went to France to command a Scottish regiment. From 1917-22 he was successively minister of munitions, secretary for war, and secretary for the colonies, and retired from public life in 1922 to write *The World Crisis 1916-18*. In 1925 he became chancellor of the exchequer, and during the next four years returned England to the gold standard and assisted in settling disputes on international debt questions. He has published, besides those works mentioned above, *Lord Randolph Churchill*, 1906; *The Aftermath*, 1918-28; *My Early Life*, 1930, and *The Unknown War*.

CHURCHILL RIVER, a stream traversing Saskatchewan and Manitoba, Canada. It rises in Methy Lake in western Saskatchewan, flows east and north-east through a series of lakes and enters the west side of Hudson Bay near Fort Churchill. Its length is estimated at 925 mi. The stream has many rapids but is extensively navigated by canoes. The portage of La Loche, a distance of 12½ mi., connects the headwaters of the Churchill with the Clearwater, a tributary of the Athabasca.

CHURCHING OF WOMEN, an act of thanksgiving after childbirth, the mother going to church to receive the blessing. The Old Testament conception of purification is not the object of the rite as, according to the Christian view, there is no impurity in childbearing. The rite, although recommended, is not obligatory. In the Roman Catholic rite the mother kneels at the altar rail and holds a lighted candle. The priest sprinkles her with holy water, recites Psalm 23, and leads her to the altar rails, where the *Kyrie eleison*, *Pater noster*, versicles and responses are said, then a prayer for mother and child, followed by the benediction. In the form prescribed by the Anglican rite, the service consists

of an exhortation, a hymn consisting of verses and parts of verses from Psalm 116, the Lord's Prayer, responsive prayer and a prayer of thanksgiving, which may be used alone at the discretion of the minister, the rest being omitted. The rite, however, is almost obsolete.

CHURCH OF ENGLAND, the parent communion of the Anglican Churches throughout the world, including the PROTESTANT EPISCOPAL CHURCH of the United States of America, under which latter title the present position of these bodies is dealt with. In what immediately follows, we outline the history of 14 centuries out of which Anglicanism, as we know it, has emerged. At the Synod of Whitby, 664, the royal authority of Oswin, King of Northumbria, associated the English Church with the Roman obedience, and, 1066, the invading army of William the Conqueror was blessed by the Pope.

Resistance to Pope's Authority. In a spiritual sense, England was thus incorporated in Catholic Christendom. But there was a steady resistance to the Pope's temporal and administrative authority. The Conqueror refused, 1076, the demand of fealty, made by Gregory VII, and insisted that, without his leave, no Papal letters or legate should be received in England, no synod called, and no baron or servant of the King excommunicated. Secular and spiritual courts were separated. As archbishops of Canterbury, SAINT ANSELM and THOMAS À BECKET came into conflict with William II and Henry I (see CONSTITUTIONS OF CLARENDON), and over the election of STEPHEN LANGTON, as archbishop, King John quarreled with the Pope so violently that in 1206 the land was laid under an interdict. Hard pressed, John did homage to the Pope in 1213 for his kingdom and conceded the nomination of bishops. Over this and other patronage there arose, however, a prolonged struggle. When the Pope demanded, 1226, a prebend from every cathedral and monastery he was refused. Yet in 1317, John XXII "reserved" the appointment of 18 bishoprics in England during the next 17 years. A safeguard against this use of authority was the Statute of Provisors, 1351. In 1229, the Pope levied one-tenth of the property of the clergy, and in 1256 there was the first claim to annates. Refusing to grant supplies to Rome, 1296, the clergy were outlawed. The jurisdiction of the Pope (1353) was severely limited by the STATUTE OF PRAEMUNIRE. The accumulation of property by the Church was checked by the Statutes of Mortmain, 1279 and 1391, and in 1414 the property of priories belonging to foreigners was confiscated to the Crown. On various occasions, bishops suppressed monasteries and founded colleges instead. Indeed, as Cardinal and Papal Legate, THOMAS WOLSEY, a candidate for Pope, so dealt with about 40 foundations. When, therefore, HENRY VIII demanded his divorce, the ground had been prepared for the Reformation.

Radical Changes in Church. Whether those events broke the continuity of the Church of England is a question on which historians differ. The changes

were profound and, in 1559, were summed up in the Act of Supremacy and Act of Uniformity, these being known as the Elizabethan Compromise. The monastic institutions had disappeared. The clergy were allowed to marry; the Bible and Prayer Book, hitherto recited in Latin, were made available in the English language; the authority of the Pope, spiritual and temporal, was repudiated. But orders of clergy, bishops, priests and deacons, with a prescribed liturgy, were retained. As in the Middle Ages, the Church was still an integral part of the State. Its doctrines were endorsed by Parliament. The bishops, deans and many other dignitaries were appointed by the Crown. Every subject of the King was held *ipso facto*, a member of the King's Church, and it was essential that he should worship as His Majesty worshiped and in no other way. Severe laws were passed, therefore, against Roman Catholics who still retained their allegiance to the Pope (see CATHOLIC EMANCIPATION) and against Protestants who desired a simpler worship than the Anglican form and did not accept the spiritual authority of King and Bishops. (See NON-CONFORMISTS.) For the enforcement of Uniformity, there was established permanently in 1583 the HIGH COMMISSION COURT, and this was the situation from which the PILGRIM FATHERS escaped, 1620, in the Mayflower.

Three Main Divisions. The endeavor of the Church to be national and comprehensive has meant that it includes three elements. The High Churchman emphasizes the Catholic tradition, expressed in the orders of clergy, vestments and ceremonial and sacraments. The Low Churchman insists rather on the reformed or evangelical doctrines, included in the Prayer Book and on the rejection of certain Roman dogmas and practices. The Broad Churchman is less concerned with the precise creed and ceremonial to which he conforms than with what he holds to be the essentials which underlie all methods of religious expression.

During the later years of Elizabeth, the Puritans, or Low Churchmen, gained the ascendancy and the Church was approximating to Presbyterianism. (See PRESBYTERIAN CHURCH.) As Archbishop of Canterbury, Laud made a desperate attempt to restore the Catholic ritual. He was defeated and, 1645, executed. In 1641 the Commons issued a Commission to demolish images, altars and monuments in the churches. Bishops were excluded from the House of Lords, and in the ROOT AND BRANCH BILL, the episcopacy was legally abolished. In 1654 "Triers" were sent around the country to examine the clergy. All this, however, merely meant that the Elizabethan Compromise was held in abeyance. When the Commonwealth was over and Charles II returned to the throne, the bishops as a body were found still in being and, at the Savoy Conference, they met the Presbyterians and endeavored to arrive at an agreement. This early attempt at reunion failed, a circumstance which means that the King is an Episcopalian in England but becomes a Presbyterian when he crosses the River Tweed

and enters Scotland; and an Act of Uniformity, 1662, again enforced what, broadly, was the Elizabethan Prayer Book. The difficulty of dealing with Non-conformists and Roman Catholics continued, and during the 18th century, the Established Church, dominated on the whole by the Broad School, failed also to retain the Methodists. (See *METHODISM*.) In 1833 the OXFORD MOVEMENT, reviving the ecclesiastical enthusiasms of William Laud, led to a far-reaching development of doctrine and ceremonial in the Catholic direction. P. W. W.

CHURCH OF SCOTLAND, THE, was established by an act of Parliament in 1560 in accordance with the creed and polity proposed by JOHN KNOX. The officers of the church, as at Geneva, were ministers, elders and deacons. The Stuart kings, by repeated restorations of Episcopacy and by an attempt even to impose upon the Scotch a liturgy like the Anglican, drove the Church of Scotland into a prolonged opposition and into the Solemn League and Covenant with the Parliamentary party to England. The Westminster Assembly, 1642, worked out a form of Presbyterianism for both lands. CHARLES II again restored Episcopacy and persecuted the conventicles which separated rather than comply. The accession of William and the Edict of Toleration in 1688 brought the Church of Scotland to the side of the crown, but lay patronage succeeded Episcopacy as a source of friction. In 1733 secessions began in the interests of ecclesiastical independence. The separated groups came together in 1847 as the United Presbyterian Church. Again in 1843 a party led by Thomas Chambers withdrew rather than recognize the decision of Parliament that the Assembly had no right to veto a pastor forced on a congregation by a patron against the will of the people. This secession was called the Free Church of Scotland. In 1900 these two dissenting groups combined to form the United Free Church of Scotland and in 1929 this body was reunited with the Church of Scotland.

CHURCH OF THE LIVING GOD, THE, denominates three religious bodies of Negro Christians, similar in character but differing in certain details. The first of these three churches was organized in 1908 and is principally located in Texas, where it has between 2,000 and 3,000 members. The second, known as the Church of the Living God, Christian Workers for Fellowship, formerly called Christian Workers for Friendship, was organized at Wrightsville, Ark., in 1889. This body is the largest of the three, and its approximately 200 churches are found chiefly in Arkansas, Texas, Oklahoma and Tennessee. The third, called the Church of the Living God, General Assembly, formerly called also the Apostolic Church, was organized in 1902 from members who withdrew from the second sect mentioned. Its 12 churches are located chiefly in Texas and Oklahoma.

CHURCH OF THE NAZARENE, officially known as the Pentecostal Church of the Nazarene, came into existence toward the close of the 19th cen-

tury, through the amalgamation of three "Pentecostal" movements separately organized in New England, New York and Los Angeles. The doctrine of the body is in essence similar to that of Methodism, but the members of the Pentecostal churches emphasize the doctrine of "entire sanctification" as taught by John Wesley, whereby "the regenerate soul is cleansed from inbred sin and made pure in heart." The movement is found in most of the states of America, the strongest churches being in California, Texas, Oklahoma, Tennessee and Illinois. Missionary work is conducted in Africa, South America and the Orient. The census of 1926 reported 60,028 members in the Church of the Nazarene.

CHURCH UNION IN CANADA. On June 10, 1925, the Congregational Churches of Canada, the Methodist Church and the Presbyterian Church in Canada came together to form The United Church of Canada. It was a real organic union, the three denominations being completely merged in The United Church and all their assets and enterprises coming under its control. Legislation had previously been secured from the Dominion and the various Provinces settling questions of property and guarding the rights of dissentients. The union was consummated in a religious service culminating in a Communion Service in which over 7,600 persons participated.

The past history of the three denominations had prepared them for this act. In Canada the sect, or denomination, had never been preserved for its own sake. Whenever a particular issue which had caused a division was out of the way, the bodies which it had severed were ready for reunion. Consequently a series of unions, beginning in 1817 and culminating in 1875, had brought all bodies of Presbyterian origin together to form the Presbyterian Church in Canada; a similar series of unions had brought together the different branches of Methodism to form the Methodist Church; and two unions had brought together the Congregational Churches. Each of these unions was formed with the expectation of future unions wider still, and thus through the years a deep conviction took possession of the people that the union of members of the Body of Christ was the will of God.

The opening of the great West and North threw a heavy burden on the young churches of Eastern Canada. The tide of immigration rose rapidly until before the war the country received in one year newcomers from other countries to the extent of 4½% of its entire population. When the volume of migration from older to newer Canada is added some idea is gained of the task of supplying the new centers of population with the ordinances of religion and always keeping the Church in advance of the incoming multitudes. It could not have been done if rivalry between the Churches had prevailed; but first cooperation and then union prevented overlapping, and enabled the Churches to provide each new community with a center of worship and service.

It is impossible here to trace the different steps by which the union was brought into effect. It was suggested first at the General Conference of the Methodist Church in Winnipeg in 1902 by fraternal delegates from the Presbyterian Church, led by the late Principal William Patrick of Manitoba College. That body opened up the question with the other Churches and received cordial responses. Committees were appointed and for years considered questions of doctrine and polity, and at each stage were astonished at the measure of agreement reached. The first vote on the question was taken by the three Churches in 1911-12, which adopted the principle by overwhelming majorities. A second vote was taken in the Presbyterian Church in 1915-16 and resulted in such a majority for union in congregations, sessions and Presbyteries that the General Assembly of 1916 finally adopted union as the policy of the Church. The opposition to it which persisted in that body and the perplexities caused by the World War led the General Assembly of 1917 to postpone the issue until the second year after the close of the war, and in accordance with this agreement the question was taken up again in 1921 and negotiations continued until the union was consummated in 1925. About one-third of the membership of the Presbyterian Church in Canada voted not to enter the union, and this was a great calamity. At the same time the union was such a success that it was said by one of the participants: "The consummation of the union on June 10, 1925, was an event unparalleled in the history of Canada; perhaps in the ecclesiastical history of the world."

The first result was an experience of a wider and richer fellowship. The joy that swept over conference after conference from coast to coast as for the first time the ministers and members of the three uniting Churches came together in organic unity was but a faint expression of the satisfaction found by the whole Church in the union. The Church has been able to grapple with the Home Mission problem of a new and growing nation with increasing success, and at the same time to keep up its work in foreign lands. Internal difficulties, unavoidable in bringing three different systems together, have been met in such a spirit of mutual confidence and goodwill that they are gradually being overcome, and a new system wrought out which will be superior to those prevailing in pre-union days. The United Church of Canada delights to call itself a uniting Church as well as a United Church, and is holding the door open for negotiations with other Communions and looking forward to the time when there will be one flock as there has always been one Shepherd.

G. C. P.

BIBLIOGRAPHY.—Rev. S. D. Chown, *The Story of Church Union in Canada*; Thomas Buchanan Kilpatrick, D.D., *The United Church of Canada*.

CHURN. See DAIRY MACHINERY.

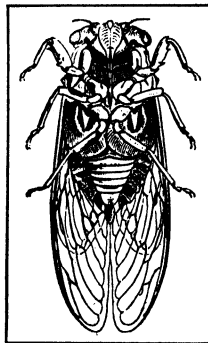
CIBBER, COLLEY (1671-1757), English dramatic poet and actor, was born at London, Nov. 6, 1671.

He was educated at the Grantham Free School, and when 19 years old went to London, where for 43 years he was connected with the Theatre Royal. His first comedy, *Love's Last Shift*, in which he played the part of Sir Novelty Fashion, made him famous both as a dramatist and actor. He produced other successful plays, including *She Wou'd and She Wou'd Not*, and *The Careless Husband*, and was created poet laureate in 1730. His *Apology* gives an account of the stage celebrities of his time in London. Cibber died in London, Dec. 11, 1757.

CIBORIUM, a drinking vessel of the Greeks and Romans. In Catholic usage it designates a baldachin above the altar, which in ancient times stood on four columns and could be closed with curtains. It signifies also the TABERNACLE and in addition the vessel in which is placed the Pyx containing the Host. In the last sense the ciborium has either the form of a chalice or of a little tower, frequently also of a gold or silver dove standing on a plate suspended on three chains from the dome of the baldachin, and called peristerium.

CICADA, PERIODICAL or seventeen-year locust, a large clear-winged insect of the order *Hemiptera*.

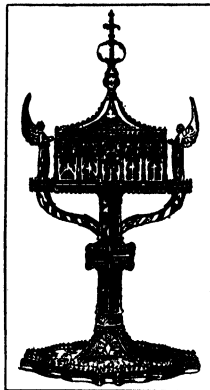
It appears suddenly in enormous numbers during late spring, lays eggs, and as suddenly disappears. The eggs are laid in slits in the twigs of various trees. The young nymphs drop to the ground, suck sap from tree roots for 12 years in the South or 16 in the North, and appear respectively in the 13th or 17th summers. When full-grown the nymphs come out of the ground, and climb the trunks of trees or other available supports. Each clings tightly to the support, while its skin splits down the back and the



CICADA
Under surface

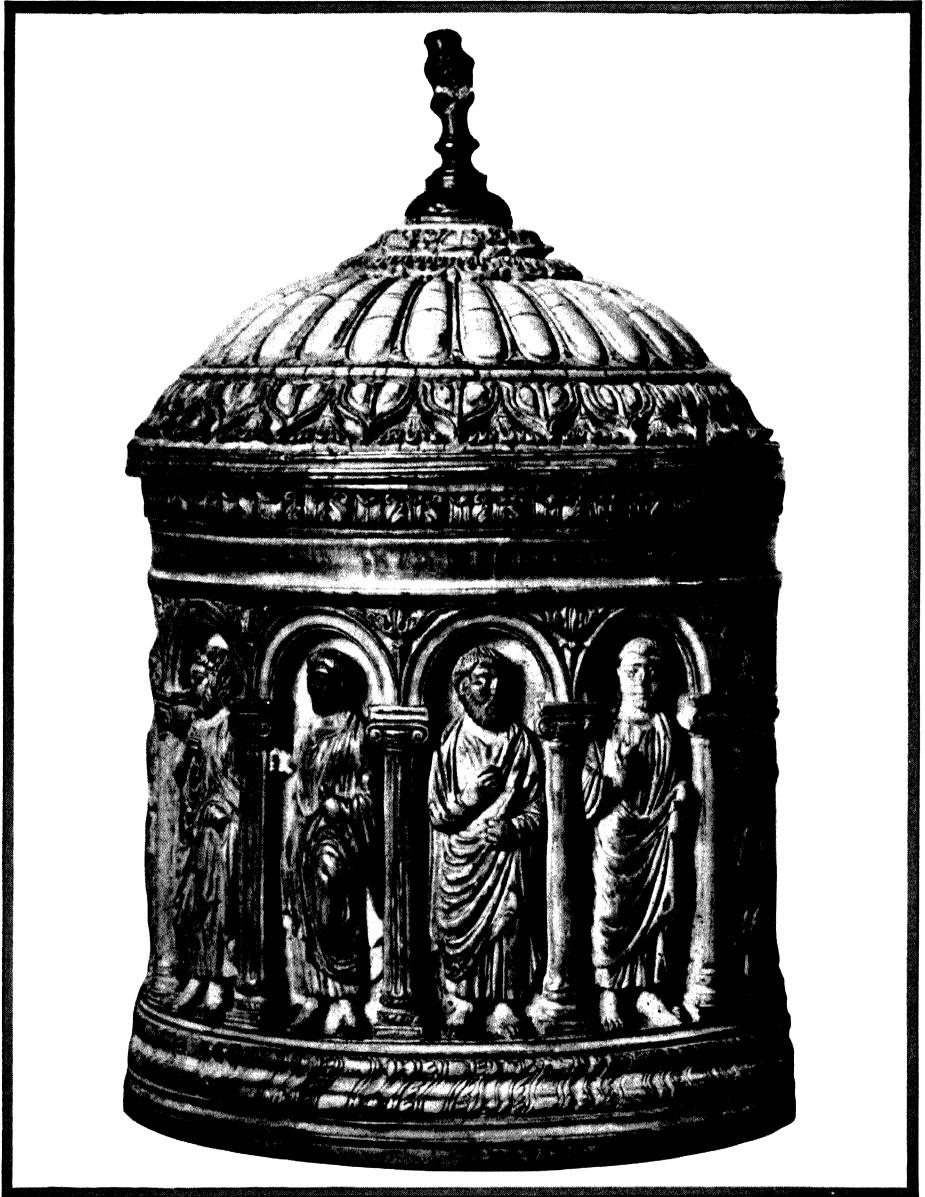
adult insect emerges. The nymphs do no appreciable damage. The females, however, injure twigs when laying eggs. The locations of 22 distinct broods have been determined by entomologists, who predict accurately when each will appear.

CICELY, SWEET, a name applied in Europe to a highly fragrant herb (*Myrrhis odorata*) and in the



SPANISH CIBORIUM OF SILVER
GILT, EARLY 16TH CENTURY

CIBORIUM



COURTESY METROPOLITAN MUSEUM OF ART

AN EARLY CHRISTIAN CIBORIUM

Ivory ciborium, probably from Antioch, carved with figures of the twelve apostles.

United States to various species of *Osmorrhiza* with aromatic roots, all of the parsley family.

CICERO, MARCUS TULLIUS (106-43 B.C.), Roman orator and philosopher, was born at Arpinum, Jan. 3, 106 B.C. He early studied oratory and later gave much time to philosophy and law. Admitted to Roman citizenship in 90 B.C., he pleaded his first case in public 10 years later. Among his famous cases were those of Sextus Roscius, whom he defended against the charge of patricide; Verres, whom he prosecuted for official mismanagement; and Milo, the slayer of Clodius, whom he defended. Although somewhat sensational, these cases gained for him recognition and won for him one public office after another. Cicero was quaestor in 76 B.C., aedile in 69 B.C., praetor in 66 B.C., and consul in 63 B.C. The coveted consulate he secured with the help of Pompey. During his consulship he exposed the Catilinian conspiracy. It is interesting to note in this connection that as early as 65 B.C. Cicero had thought of defending Catiline. Once seated in power himself he turned against the conspirator in his four eloquent invectives. In his execution of the conspirators he had hoped for support from the nobility, but failing in this he retired to Thessalonica in 58 B.C. In the civil war that followed he lost friends on both sides, due principally to his vacillating decisions. After the death of Caesar he was bitterly attacked in the senate by MARK ANTONY. To this attack he later responded with his well-known *Philippics* against Antony. Although Octavius tried to save him, Cicero was on the proscribed list. In his attempt to escape, the orator was overtaken and slain near Formiae Dec. 7, 43 B.C.

In addition to his orations Cicero wrote numerous letters and several philosophical works. In social philosophy he followed Plato in attempting to draw up a constitution and laws for the state. These he sketched in his *De Republica* and *De Legibus*. His more philosophical works include *De Finibus*, *De Amicitia* and *De Natura Deorum*. His *De Officiis* and *Tusculanae Disputationes* might also be mentioned.

CICERO, a city of Cook Co., Ill., adjoining Chicago on the east and served by three important railroad lines. The growth of population in Cicero is due in part to the expansion of Chicago and in part to attractive living conditions. Automobile parts, electrical equipment, and enamel ware are prominent among its manufactures. In 1929 the factory output reached an approximate total of \$294,000,000; the retail trade amounted to \$21,868,205. Pop. 1920, 44,995; 1930, 66,602.

CID, CHRONICLES OF THE, an imposing body of histories, poems and legends based on the adventures of the Spanish soldier of fortune, Rodrigo, or Ruy, Diaz de Bivar (d. 1099), known as the Cid or Cid Campeador. As to the actual life of the Cid, it is believed that he was descended from a noble family of Castile (his name first appears in a document of 1064); that he aided Sancho II of Léon in his victory at Lantada, 1071; that he married Ximena,

daughter of the Count of Ovideo; and, finally, that he was a superb soldier who fought ardently both with and against the Moorish forces in Spain, his chief exploit being that of the capture of Valencia in 1094. Whatever the historical facts of his life, the Cid was the inspiration of Spain's greatest epic, the *Poema del Cid*, a poem of 3,735 verses, written in a barbarous style about 50 years after the hero's death; of some 200 inferior ballads, chiefly of the 16th century; and of numerous chronicles, the most noteworthy of which are that discovered by Risco in the convent of St. Isidro at Léon (dated before 1258), the *Cronica general* by Alphonso X (d. 1284), the *Cronica particular* (published by J. de Velorodo in 1512), and, in English, Robert Southey's *Chronicle*, 1808. The drama of the Cid by the French poet, Pierre Corneille, was written in 1636.

BIBLIOGRAPHY.—*The Chronicle of the Cid*, trans. by R. Markham, 1883; H. B. Clarke, *Cid Campeador*, 1897; *Poem of the Cid*, trans. by A. M. Huntington, 1921.

CID, LE, an opera in four acts by JULES MASSENET, libretto by d'Ennery, Gallet and Blau; première, Paris, 1885, New York, 1907. The libretto is based upon incidents in the life of Rodrigo, the Spanish warrior, known also as Le Cid or The Conqueror.

In the opera, Rodrigo fights a duel, on behalf of his father, with Count Gormos, father of Chimène, to whom Le Cid is betrothed. When the latter kills the count, Chimène demands his life from King Ferdinand IV. The king, who values Rodrigo for his military prowess, declines to give him up until after an impending battle with the Moors. Chimène remains steadfast in her demand for retribution until Rodrigo, confronted with death for slaying the count, is about to commit suicide. Then the girl stays his hand and confesses that she loves him.

CIDER, the juice of apples, extracted from crushed apple pulp. "Sweet cider" is juice in which little or no fermentation has taken place, so that most of the sugar is unchanged. "Hard cider" is fermented until almost all of the sugar has been changed to alcohol and carbon dioxide, leaving a bitter flavor. Fermented sweet cider contains from 2 to 3% alcohol, while hard cider may contain 8% or more.

BIBLIOGRAPHY.—*A Study of Cider-making*, United States Department of Agriculture, Bureau of Chemistry, Bulletin 71, 1903.

CIENFUEGOS, a city of Cuba, Santa Clara Province, situated on Cienfuegos Bay on a peninsula about 185 mi. by rail southeast of Havana. It has an excellent harbor and the port is one of the most important of Cuba. Cienfuegos is well-built with wide streets, and is amply provided with all modern municipal conveniences. The city lies in one of the most picturesque districts of the island and is the center of the sugar industry on the southern coast. Sugar, tobacco, molasses and cacao are exported. Est. pop. 1930, 39,946.

CIERVA, JUAN DE LA (1895-), Spanish inventor, was born at Murcia, Sept. 21, 1895. As a boy of 14 he began constructing airplanes, and while

studying civil engineering he built in 1918 the first 3-motored airplane of the modern type. Cierva had built many gliders of varying types before working out his theory of flight by laboratory calculations. In Jan. 1923 Cierva devised and successfully demonstrated the Autogiro, a plane given added stability by an arrangement of "windmill" blades revolving at right angles to the propeller and independently of the engine unit. The invention was widely hailed as a signal achievement in airplane construction, since by decreasing the force of gravitation the autogiro is enabled to land at greatly reduced speed and consequently with added safety. In September 1928 Cierva successfully flew across the English Channel in an autogiro, and in 1930 and 1931 visited the United States where he arranged for American manufacture of his type of plane. He published *Wings of Tomorrow*, 1931.

CIEZA DE LEON, PEDRO DE (c. 1519-1560), Spanish soldier and historian, born in Seville. He came to America about 1532 or 1534 and in 1539 accompanied Alonso Heredia to Darien. In 1538 he made an expedition up the Cauca River Valley (Colombia) with Vadillo. Subsequently he served under Jorge de Robledo, and after his execution by Belalcázar, Cieza de Leon passed into the service of this conqueror who was governor of Popayan. From 1541 to 1550, when he returned to Spain, he kept a diary of his adventures throughout what is to-day Colombia, Ecuador, Peru and Bolivia. In 1553 he published his *Cronica de Peru*. This work is divided into four parts, of which part three, containing the history of the conquest, is lost, and a portion only of part four, recounting the civil wars, has been found. Parts one and two, treating the geography of western South America and the customs and history of the Incas, is an excellent source for the pre-conquest history of Peru.

CIGAR-FLOWER (*Cuphea platycentra*), a small, shrubby, much branched plant of the loosestrife family, native to Mexico and commonly grown as a pot and bedding plant. It derives its name from its slender, bright red flower-tube, which with a black ring at the end and a white mouth, resembles a burned-out cigar.

CIMARRON RIVER, a stream of Oklahoma, rising in the Raton Mountains in the northeastern section of New Mexico. It flows eastward into the panhandle of Oklahoma, enters Kansas at the southwestern angle of that state and traverses several of the southern counties before reentering Oklahoma at the eastern border of Harper Co. From this point the Cimarron flows southeast and east until it empties into the Arkansas River at the southern border of Osage Co. It is fed by numerous creeks and drains a fertile, rolling area devoted mostly to wheat raising and other agricultural pursuits. The river's length is estimated at 650 mi. but because of its shallow channel the Cimarron is not navigable.

CIMBRI, an ancient tribe of people who probably came originally from Jutland, a region known to their contemporaries as Cimbric Chersonese. In their south-

ward wanderings the Cimbri came into repeated conflict with the Celtic tribes on both banks of the Danube, and even penetrated the Roman province of Noricum. In 113 B.C. they defeated the consul Gnaeus Papirius Carbo near Noreia, and four years later, having crossed the Rhine, they defeated the consul Marcus Junius Silanus in southern Gaul, 109 B.C. Under their king, Boiorix, they inflicted still another rout upon the Romans in 105 B.C., the Roman losses on this occasion numbering approximately 8,000. After a brief stay in Spain, where they found it difficult to make much headway against the warlike inhabitants, they returned to Gaul, in 103 B.C. Thereupon they united forces with the Teutones and some of the Helvetii, and a joint expedition against Rome was organized. The invaders formed two contingents, the Teutones proceeding southward by a westerly route, and the Cimbri heading for the eastern passes of the Alps. The Teutones were destroyed by Roman forces at Aquae Sextiae in 102 B.C., but the Cimbri were able to fight their way down to the valley of the Po River. They were completely destroyed in 101 B.C. on the Raudine Plain near Vercellae by Marius who had been made consul for five years in order to save Rome from the invading hordes.

CIMMERIANS or **CIMMERII**, an ancient people whose place of origin is not definitely known. They are referred to in Homer's *Odyssey* as living in a land of eternal darkness, presumably northern or western Europe. Herodotus mentions them in his works as having been driven from southern Russia through the Caucasus and into Asia Minor by the Scythians. Assyrian sources record an invasion by northern nomads named *Gimmirai*, and it has been established that in the middle of the 7th century B.C. such wanderers did destroy Magnesia and other towns in Asia Minor. The Cimmerians finally were beaten in battle and destroyed or driven out by Alyattes of Lydia. They may possibly have been the forefathers of the later tribes called Cimbri, who inhabited Jutland.

CIMON (c. 507-449 B.C.), Athenian statesman, admiral and general, son of Miltiades. He fought courageously at the BATTLE OF SALAMIS in 480 B.C. Later as commander of the entire Greek fleet he wrested the coast of Thrace from the Persians, and freeing Greek cities on the coast of Asia Minor, he defeated the Persians on land and sea at the mouth of the Eurymedon River, 466 B.C. Succeeding THEMISTOCLES and ARISTIDES he built up the DELIAN LEAGUE, which now that enrollment was no longer voluntary was gradually transformed into an Athenian empire. Regarding Sparta as a partner in the leadership of Greece worthy of Athens he conducted an army into Messenia in her behalf. This expedition failed and Cimon's political enemies in Athens secured his banishment, c. 461 B.C. Athens and Sparta after ten years of desultory warfare again resumed friendly relations in 451 B.C., at which time Cimon seems to have been recalled to Athens. He died in the course of a campaign in Cyprus against the Persians.

CINCHONA, a numerous genus of evergreen trees and shrubs of the madder family, several of which yield Peruvian bark, the source of the valuable drug quinine. The genus was named in honor of the countess Chinchon, wife of the Spanish governor of Peru, who, in 1638, was cured of malarial fever by the use of the bark. There are about 40 species, natives of the Andean region of South America from Colombia to Peru, several of which are grown commercially in Java, India, Jamaica and other warm countries. They are mostly shrubs or medium-sized trees with smooth, opposite leaves, whitish or rose-colored, fragrant flowers in terminal clusters and a grooved fruiting capsule containing numerous winged seeds. Because of the world-wide medicinal demand for cinchona bark and the wasteful methods of securing it, the native forests were threatened with extinction. In 1854 the Dutch government began growing cinchona trees in Java whence their cultivation has become widely established.

CINCHOPHEN, small colorless crystals or powder, having slight odor and bitter taste. It is the more common name for phenylcinchoninic acid, $C_{20}H_{21}O_7$. Insoluble in most solvents. Cinchophen increases the permeability of the kidneys to uric acid. It is also an analgesic and is, therefore, used especially in arthritis (rheumatism) and gout. It is a common ingredient of medicine sold to the public for rheumatism. Its promiscuous use by the public for the relief of pain has been the cause of many deaths.

CINCINNATI, 2nd city of Ohio, and 17th of the United States, situated in the southwestern corner of the state, on the north bank of the Ohio River, at $39^{\circ} 6' N.$ lat. and $84^{\circ} 31' W.$ long. The city is 250 mi. south of Cleveland. The population in 1920 was 410,247; in 1930, 451,160, of which only 34,835 were foreign-born. In January the average temperature at Cincinnati is $30^{\circ} F.$, in July $75^{\circ} F.$ The average annual precipitation is 38.6 in.

Cincinnati, seat of Hamilton Co., is built on the northern side of a circular series of hills, cut east and west by the Ohio River and north and south by the Licking River, which empties into the Ohio from the south. The corporate area covers 72.5 sq. mi. The city is built on two terraces, one approximately 60 ft. above the river at low water; the second, 112 ft. The second plateau leads to hills ranging from 550 to 960 ft. above sea level. East and west of Cincinnati flow the Little Miami and Great Miami rivers respectively, emptying into the Ohio from the north. Flowing through the city is Mill Creek. There are 23 mi. of river frontage. The Ohio is spanned by 5 bridges leading to Covington, Ludlow and Newport, Ky.

Except in the hilly sections the 750 mi. of streets are laid out regularly. The leading retail establishments flank the streets on the higher sections north of Third Street. Noteworthy structures include the United States Government Building, county courthouse and the Cincinnati General Hospital group. The 90 parks

cover an area of 3,162.4 acres. (See also TYLER DAVIDSON FOUNTAIN.) The University of Cincinnati is an important municipal institution, its College of Engineering and Commerce being the birthplace of the cooperative system of education.

Transportation inside the city is afforded by electric street railway and bus lines. The city owns the Southern Railway operating between Cincinnati and Chattanooga, Tenn. There are 8 railroads, including the Baltimore and Ohio, the Pennsylvania and the Big Four. River steamers operate regularly to Louisville and Pittsburgh. There are 5 airports.

The chief manufactures are soap and kindred products, metal and wood products, clothing, meat products, printed and published material and motor vehicles. In 1929 manufactures were valued at approximately \$520,000,000; the retail trade amounted to \$291,572,167; the wholesale trade proper, to \$350,147,680. In 1930 Cincinnati together with Hamilton Co. had a wholesale trade, all establishments, valued at approximately \$735,711,506. Total river borne traffic in 1930 through locks, open river and ferries, amounted to 23,917,507 tons.

Cincinnati was founded in Dec. 1789 by a group of white settlers in the Northwest Territory. It was named by Gen. St. Clair, in honor of the Pennsylvania society of the Order of Cincinnati, of which he was president. The community was incorporated as a town in 1802 and as a city in 1819. With the advent in 1816 of steam navigation on the Ohio, Cincinnati grew rapidly in importance. On Sept. 1, 1862, during the Civil War, Gen. Lew Wallace issued a proclamation that the invading Confederate forces were approaching and that the citizenry should arm; so great was the response that when the invaders appeared, they retreated immediately, alarmed at the size of the army confronting them. The canalization of the Ohio River in the Cincinnati district was completed in 1929.

Cincinnati is noted artistically for its May Festival, Symphony Orchestra, College of Music, Conservatory of Music, Art Academy and Institute of Fine Arts.

CINCINNATI, SOCIETY OF THE, a memorial society, formed May 13, 1783 by officers of the Continental army, both American and foreign, before leaving their camp near Fishkill, N.Y., at the close of the American Revolution. The object of the society was to perpetuate the remembrance of the war and continue the friendships formed under the pressure of common danger.

George Washington was elected president at the first meeting, held in May 1784. It was decided to limit the membership to American and foreign officers who had served 3 years or who had received an honorable discharge for disability. Among the European members were Lafayette and Steuben. From the beginning, and for many years, there was great opposition to the society as an un-American and aristocratic institution. Between 1824 and 1893 there was little activity among the members but in the following 9 years the branches in the original 13 states

were re-formed. The present membership, descendants of the founders, numbers about 1,200. A bald eagle, symbolizing the union of France and America is the emblem of the organization. On its breast is a representation of the Roman CINCINNATUS receiving a sword from the senate, and his wife standing in the doorway of their cottage is pictured in the background. The inscription is *Omnia reliquit servare rem publicam* (He left all to serve the republic).

CINCINNATI, UNIVERSITY OF, a coeducational municipal institution incorporated in 1870 by the city of Cincinnati, O. Because of inadequate funds the academic department was not organized until 1894, when public taxation added to the institution's support. The university comprises colleges of Engineering and Commerce, Medicine, Education, Liberal Arts and Law and a Graduate School. Evening classes are held in the College of Liberal Arts. The university had productive funds in 1930 amounting to \$6,947,950. The library of 233,769 volumes includes eight departmental libraries. In 1930-31 there were 10,750 students and a faculty of 596 headed by Pres. HERMAN SCHNEIDER.

CINCINNATUS, LUCIUS QUINCTIUS, a hero of early Rome, famed in story for his simplicity of manners. Living on his small farm he was twice summoned from the plough to assume the dictatorship in Rome, 458 and 439 B.C. Triumphant over the Aequi, he returned to his farm. An opponent of the plebeians he defended the ancient privileges of the patricians. Legend has exaggerated his virtues and accomplishments beyond all belief.

CINDERELLA, the heroine of a fairy tale, first popularized by Charles Perrault in 1697. This is the story, possibly Oriental in origin and extremely widespread, mentioned in 16th century German folklore, of a young girl who is one night transformed by her fairy godmother from the ugly drudge of her cruel half-sisters into a radiant princess. She goes in state to a great ball, and there a prince falls in love with her, loses her, but eventually marries her when he discovers her by a certain glass slipper that will fit only Cinderella's foot.

CINERARIA, a handsome pot-plant originated by florists from species of groundsel (probably *Senecio cruentus*), native to the Canary Islands. It is a short-stemmed, very woolly plant, bearing large, long-stalked, heart-shaped leaves and dense clusters of purple-red flowers, running into showy double forms, ranging in color to pink, blue and white and often variegated.

CINNA, HELVIUS GAIUS (fl. 50 B.C.), Roman poet, was the contemporary and intimate friend of Catullus. According to Plutarch the poet was identical with the Caesarian tribune of the people, Helvius Cinna, who, being mistaken for the conspirator Cornelius Cinna, was torn to pieces by an infuriated mob on the day of Caesar's funeral. Cinna's chief work was the epic poem entitled *Smyrna*. It deals with the incestuous love of Smyrna for her father, Cynarus. Several fragments of this

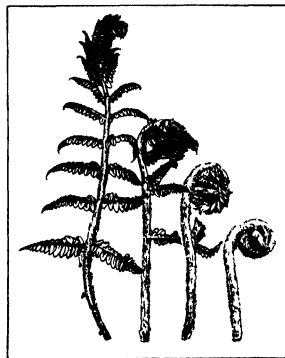
poem are extant. Another poem, *Propempticon Polionis*, is attributed to him.

CINNABAR, the only important ORE of mercury, called also vermillion and mercury blende. It is brilliant red to reddish brown, but may be colored black by impurities. Cinnabar is found in granular or earthy masses as a brilliant scarlet powder, and in crystals of the HEXAGONAL SYSTEM. It is mercuric sulphide. Deposits of this ore are found generally in veins and impregnations in SLATES, SHALES and SANDSTONES, and may be seen in process of formation at hot springs in California and Nevada. Important commercial deposits are found in California and Texas, and in Italy, Spain and Austria.

Mercury, or quicksilver, is used in the manufacture of drugs and chemicals, explosives, electrical apparatus and cosmetics. Vermilion paint is made of cinnabar. See also ORE DEPOSITS.

CINNAMIC ACID, a white crystalline acid ($C_9H_8CH:CH.COOH$), occurring chiefly in storax and in the balsams of Tolu and Peru. It is commonly prepared by heating benzaldehyde with acetic anhydride and dehydrated sodium acetate. It is used in perfumes and in the treatment of tuberculosis.

CINNAMON FERN (*Osmunda cinnamomea*), a handsome species of flowering fern. It is found in wet woods, swamps and low grounds widely in eastern North America and various other regions, often covering large areas with its conspicuous foliage. The crozier-shaped young fronds, often called fiddle-



CINNAMON FERN
Young fronds showing fiddle-head stage

heads, which rise in early spring from very stout long-lived rootstocks, are covered with a dense coat of silvery-white wool that falls away as the fronds unfold. The green, deeply cut sterile fronds, 1 to 6 ft. high, grow in a circle enclosing the much shorter, contracted, early withering, fertile fronds which are crowded with bright cinnamon-red spore cases.

CINNAMON TREE (*Cinnamomum zeylanicum*), a small evergreen tree of the laurel family with aromatic bark yielding a valuable spice. It is a native

of India and Malaya widely cultivated in the tropics, especially in Ceylon. The tree, which grows 20 to 30 ft. high, bears very stiff, oblong leaves, yellowish-



COURTESY N. Y. BOTANICAL SOCIETY

CINNAMON TREE
(*Cinnamomum zeylanicum*). Flowering branchlets

white flowers in silky clusters and a dry, pointed, somewhat berry-like fruit. Oil of cinnamon, extracted from the bark, is used in medicine and also for flavoring. In cultivation the tree is cut back so as to cause the production of numerous young shoots the bark of which, peeled off and rolled up, is the cinnamon of commerce. This spice has been highly prized since remote antiquity. Moses, according to Exodus 30:23, was commanded to use cinnamon. Herodotus, the Greek historian, and other ancient writers mention it.

CINO DA PISTOIA (1270-1336), Italian poet and lawyer, was born in Pistoia in 1270. Of a noble family, his real name was Guittoncino de' Sinibaldi. After studying law at Bologna, he returned to his native city, only to be forced to leave because of entanglements with the Guelph and Ghibelline factions. He now visited Rome and France. In his 44th year he became doctor of civil law at Bologna, thereafter lecturing at various universities and distinguishing himself as a jurist. In his spare time he occupied himself with literature, continuing the tradition of DANTE. Carducci places him midway between Cavalcanti and Dante. Dante himself refers to him in the treatise *De Vulgari Eloquentia* as one who had written poems in modern Italian. Cino died obscurely in 1336.

CINQUECENTO STYLE, the style of Italian Renaissance contemporary with the 16th century, especially of the earlier part of the century. The word is generally used as synonymous with the Italian High Renaissance, and although Baroque forms were common before the end of the century, the entire Baroque movement is excluded from the term. In general, the Cinquecento style is characterized by extraordinary artistic creativeness along classical and carefully schooled lines. It is the period alike of Raphael and Michael Angelo, Bramante, Peruzzi, Sansovino, Giovanni Bellini and Giorgione. Its ideals were classical dignity, restraint and perfection of detail, disciplined

richness, careful composition, and a passionate search for beauty. At its best, the style was quiet, commanding, refined, delicate, lovable, striving for a careful balance between monumentality and intimacy. At its worst it degenerated into coldness and occasional academic dullness which prepared the way for the great reaction to follow, the Baroque. For bibliography see RENAISSANCE ARCHITECTURE.

CINQUEFOIL, a name derived from the French meaning five-leaved, often given in the United States to various species of five-finger (*Potentilla*), both native and cultivated. See also POTENTILLA.

CIPANGO, also known as Zipango, a legendary island which was described in Marco Polo's *Voyages* as lying about 1,500 mi. from land, and as being a place of miracles and fabulous riches. It is recorded that Columbus and other early navigators searched diligently for the island.

CIRCASSIA, the old historical division of Caucasia, a mountainous region in the southeast of European Russia, lying chiefly on the north slope of the Caucasus, partly on the south, and bounded on the west by the Black Sea. The mountains, of which the culminating heights are those of Mt. Elbruz, are intersected with steep ravines and clothed with thick forests, and the territory is principally drained by the Kuban. The climate is temperate.

The early history of Circassia is obscure. Between the 10th and 13th centuries it formed a portion of



P. A. NYDBERG "FLORA OF PRAIRIES AND PLAINS"

SHRUBBY CINQUEFOIL
Potentilla fruticosa



COURTESY MUSEUM OF FINE ARTS, BOSTON

ODYSSEUS AND CIRCE
From a 6th century B.C. Greek kylix

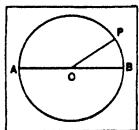
Georgia, but in 1424, the Circassians were an independent people. Wars with the Tartars took place until 1705, when the Tartars were defeated in a decisive battle. In 1829 the country was formally annexed by the Russians. A long resistance was made by the Circassians under their leader Schamyl, but the conquest of the country by the Russians was completed in 1864, and the Circassians to the number of approximately 400,000 emigrated to the Turkish provinces.

CIRCE, in Greek mythology, a sorceress, daughter of Perse and HELIOS. She lived on the island of Aeaea

where she turned the companions of Odysseus into swine with her magic drink; Odysseus, however, had been given an herb by HERMES which kept him from being transformed. He afterwards persuaded Circe to restore his companions. Odysseus lingered for a year on the island, and Circe taught him how to communicate with Tiresias in the shades and learn his future.

CIRCINUS (gen. *Circini*), the compasses, a small constellation consisting chiefly of three stars, closely adjoining Alpha Centauri. See *STAR: map*.

CIRCLE, a closed plane curve (formerly the space bounded by it) generated by a point moving at a constant distance from a point in the plane called the



center of the circle. The line from the center to the moving point is the radius of the circle. The length of the circle is called the circumference, and the term is also applied to the circle itself. In this figure *O* is the center, *OP* is a radius, *AB* is a diameter, and *BP* is an arc. The area of, or the space inclosed by, a circle is πr^2 , and the circumference is $2\pi r$, or πd . See *CONICS*.

CIRCLEVILLE, a city in southern Ohio, the county seat of Pickaway Co., situated on the Scioto River, 25 mi. south of Columbus. Bus lines and three railroads afford transportation. The chief crops of this region are wheat, Indian corn and sweet corn. Canning is the principal industry. The city was plotted in 1810, and incorporated in 1814. Southeast are Hocking Parks, several State preserves of fine timber. Pop. 1920, 7,049; 1930, 7,369.

CIRCUIT, a continuous conducting path for ELECTRICITY. In order that an electric current may flow continuously in one direction around a circuit (direct current), the circuit must be closed. In other words, the series of wires and connected appliances making up the circuit must be so joined as to form a path. Under the ELECTRON THEORY, the electric current in a metallic CONDUCTOR is a stream of ELECTRONS. The closed metallic circuit, therefore, is continuous in the sense that a stream of electrons may flow completely around it. In a closed, direct-current-dynamo circuit, for example, the electrons may flow from the dynamo (see DYNAMO ELECTRIC MACHINE) out through the wires and the connected receiving devices and back through other conductors to the dynamo. Arriving at the dynamo, they flow through conductors in the machine itself, thence once more through the connected circuit. Essentially, a direct-current dynamo, or a battery, is a sort of electricity pump which causes a limited number of electrons to flow continuously around a circuit. The flow of water in a hot-water heating system is analogous to the flow of electricity in a direct-current circuit.

In an ALTERNATING-CURRENT circuit, the electrons do not move continuously in one direction, but surge to and fro. An important property of such a current is that it may flow in an open circuit, provided the break in the circuit is bridged by a CONDENSER. A

familiar illustration is afforded by the arrangements in an ordinary central TELEPHONE system. When a subscriber places his receiver on the hook-switch, the metallic circuit is automatically broken, and the direct current from the central office which is used in the talking circuit can no longer flow. Nevertheless, central can ring the subscriber's bell by means of an alternating current which surges into and out of a condenser bridged across the line at the subscriber's station. L. B. S.

CIRCUIT BREAKER, a mechanical device used for the interruption of an electrical circuit under abnormal conditions. The contacts of the breaker are held closed by a toggle lever and they separate when the breaker is tripped by a SOLENOID. The solenoid may be energized directly, as by overload current, or it may be energized by RELAYS. Direct current breakers are of the air-break type; for alternating current up to 550-600 volts, both air-break and oil circuit breakers are used; for higher voltages oil is necessary to prevent arcing between the breaker contacts.

CIRCUIT COURTS. See SUPREME COURT OF THE UNITED STATES.

CIRCULATING MEDIUM, any form of payment for goods which is generally acceptable and passes freely from hand to hand, its value independent of the CREDIT standing of the bearer. All forms of MONEY are circulating media, but so also have been at times many different commodities and devices. WAMPUM among the American Indians; tobacco and cotton among southern plantation owners in colonial days; beads, shells, furs and bales of cloth are examples of commodities which have been made to serve as money under PRIMITIVE ECONOMIC conditions. In more recent times, during the extreme monetary shortages of American financial panics, CLEARING HOUSE checks, private issues of PAPER MONEY and even stamps have been pressed into service, although they had no legal status as money and would probably have been held to be definitely illegal if they had been brought to test.

A circulating medium, based upon a metal universally acceptable among nations, in units adapted to the monetary habits of the people, has been found essential, ordinarily, to the economic well-being of a country. See also GOLD; FIAT MONEY. B. H. B.

CIRCULATORY SYSTEM. See VASCULAR SYSTEM.

CIRCUMCISION, the cutting off of the foreskin of males, a religious rite practiced by the Jewish people on the eighth day after the birth of a male child ever since the time of the Hebrew patriarch Abraham, and to-day also by other peoples besides the Jews as of great medical and sanitary value. The Biblical basis of the law of circumcision is provided by Genesis 17:10-14, 23; 21:4; Joshua 5:2-9. In the Bible circumcision is regarded as the sign of the covenant made between God and Abraham and binding forever upon his descendants. For this reason it is frequently called the Abrahamic Rite or the Abra-

hamic Covenant. In ancient Israel all male children were required to be circumcised, including both free born and slaves, and aliens had to undergo circumcision before they could marry into a Jewish family. The penalty for failure to be circumcised was excommunication from the Jewish people.

It is certain that the act of circumcision was actually much older than the time of Abraham, and that it was not an original nor an exclusively Jewish rite. It seems to have been a religious rite intimately connected with the attainment of youths to puberty and with marriage. It was practiced in ancient times by several of the nations of antiquity, and appears to have been the exclusive rite of no specific one of these ancient nations. Indeed, it was, at different times, practiced by the Ammonites, Moabites, Edomites, Arabians, Phoenicians, Ethiopians, and by the Egyptians (all these in the first millennium B.C., and by the Egyptians especially as early as 4000 B.C.); in the Christian Era, by the Mohammedans, Polynesians, and many of the tribes of Australia, Africa, and the American continent. The evidence is conclusive that many of the Indian nations or tribes of the United States and the South American continent practiced circumcision. The Philistines seem to have been the only neighboring people of the Israelites in ancient Canaan who were uncircumcised.

Nothing is known with definiteness as to the exact origin and purpose of circumcision. Various theories have been advanced, one the sanitary theory; the second, that circumcision is a vestige of a former religious rite of castration. A third theory alleges that the act of circumcision was performed in order to avert the evil effects of a malignant demon or deity. However, none of these theories is as plausible as the following generally accepted view that circumcision is a survival of the ancient practice of human sacrifice in which, instead of offering up the entire body of the first-born as a sacrifice to the deity, the modification first was made of offering up a part of the body of each male child, such as a joint of a finger, or a lobe of the ear, and second, the subsequent and finally adopted modification of offering up a dispensable part of the body of each male child, i.e., the foreskin, to the deity instead.

In ancient and medieval times circumcision, although not in the least regarded as a sacrament, was an indispensable prerequisite for conversion to Judaism. However, in more recent times this requirement for male proselytes is gradually being dispensed with. In 1892, in fact, the Central Conference of American Rabbis decided to abolish circumcision in the case of adult proselytes, because it is an extremely dangerous and painful measure when exercised on adults. As regards the practice of circumcision by Christians, the apostle Paul (Galatians 5:1-6) denied the necessity for the circumcision of Gentile Christians, while permitting it to Jewish Christians (Romans 2:25-29; 1 Corinthians 7:18-19). Probably as a result of the belief that the circumcision of Jesus was valid for all Christians at all times (Colossians 2:11), the early

Christian church soon eliminated circumcision as a requirement of the ritual law. A. SH.

BIBLIOGRAPHY.—A. Asher, *The Jewish Rite of Circumcision*, 1873; A. Glassberg, *Die Beschneidung in Ihrer Geschichtlichen, Ethnographischen, Religiösen, und Medizinischen Bedeutung*, 1896.

CIRCUS, a Latin word meaning "circle," the Roman name for the place in which chariot races, wrestling contests and other equestrian and athletic spectacles were staged. The origin of the circus and its evolution into the present-day extravaganza in the United States are traced with ease, owing to the abundant records left by writers, poets and singers of 2500 years.

Importance in Roman Life. The circus, which it is convenient to date from about 750 B.C., began as an exhibition solely of horses and horsemanship. With the Roman Senate established, Romulus undertook the organization of a troop of cavalry, for which he selected 300 promising youths. Their training and practice sessions aroused the interest of the populace; but there is no record of public admission to these equestrian gatherings until 329 B.C., in the description of the Circus Maximus between the Aventine and Palentine hills in Rome. In its most pretentious form, this circus was oval shaped, about 2,000 feet long and 625 feet wide; there were three tiers of stone and wooden seats, receding from the arena, which measured about 1850 by 280 feet. A water channel between the lowest row of seats and the arena proper protected the spectators from injury in the collisions sometimes occurring between contestants. The emperor was a frequent spectator at the Circus Maximus which, in the time of Julius Caesar, provided seats for 200,000.

In later Roman times, the circus lost its exclusive equestrian character. Spectators witnessed, besides feats of riding, encounters between wild beasts and human prisoners, sometimes Christians, during the Roman decline. In addition, in these later days there also were swimming and rowing races in the water channel, sack races and field events. To these spectacles, recognized by the emperors as a safety-valve for popular emotion, the people were admitted free of charge. Indeed the importance of the circus in Roman life demanded the construction of replicas of the Maximus, among which were the Circus Flaminius, 221 B.C., and the Circus Neronis.

But if in late Roman days the circus lost much of its equestrian character, the emphasis on horses and horsemanship was revived in the Middle Ages. The era of knighthood gave a new importance to the art of riding. The medieval equivalent of the Roman circus was often a riding academy where youths received instruction, and horses were trained as performers. Such was the status of the circus until the 13th century, when a band of Moorish performers introduced into Europe certain innovations in which the origin of the modern American circus may be recognized. These performers stretched ropes for dancing between ship masts in Spanish and Italian ports, did feats of tum-

bling and juggling, and rode erect upon their horses which they mounted on the run, Arab style. In the 16th, 17th and 18th centuries the best of these troupes received financial support from royalty. The latter-day circus clown was borrowed from the *commedia dell'arte* of Italy, and the menagerie and freak show were supplied to gratify the popular demand for the bizarre.

The Modern Circus. In the early 19th century the small traveling circus, comprised of horseback riders, acrobats, contortionists, freaks and performing animals was a common sight at provincial fairs in Europe. In the European cities, notably in France, the *cirque intime* was a more finished spectacle, staged indoors as it is to-day. In the United States the early circus took the form of a wagon show, usually a small tent spectacle which was drawn by horses from town to town, with its wake of camp-followers, sellers of quack remedies, shell-game artists, and other manifest frauds. Phineas Taylor Barnum (1810-91) was the first to recognize the greater possibilities of the circus, made possible by the good-natured credulity of the American people and their love of the lavish. In 1871 he established "the greatest show on earth," a three-ringed circus of male and female performers, menagerie, freaks, Wild West troupe, and countless strange features. The circus traveled in its own railroad coaches, which partially supplanted the picturesque wagons. In 1907 the vast Barnum holdings were sold to Ringling Bros., who added two or more platforms between the three rings, enlarging the scale of the magnificent Barnum. Instead of one clown, the Ringling and other big-top shows boast a parade of clowns. This motley plurality, carried out in acrobats, riders, freaks, animals and mechanical equipment, is the very essence of the American circus. The circus investment in America exceeds \$100,000,000.

CIRCUS, in architecture, a round, semicircular, oblong or elliptical space; in ancient Rome the scene of horse races; in England an open space, circular or semicircular, surrounded by houses. Historically, the Roman circus developed somewhat later than either the semicircular theater or the elliptical or round amphitheater, and resembled the oblong GREEK STADIUM. It was unlike the latter, however, in that the central open space, about which the tiers of seats were built, was permanently divided lengthwise by a raised structural barrier. This barrier, called the *spina*, was adorned with sculpture and architectural ornamentation, and its ends marked the goals. Although built primarily for horse and chariot races, the circus was also used for games and public meetings, and was flooded for mock sea-fights. The most famous was the Circus Maximus, which could seat 200,000 spectators. The English circus, in the architectural sense, is a feature of town planning which may be dated from Wren's scheme for the rebuilding of London after the great fire of 1666.

CIRENCESTER, an agricultural market town in Gloucester Co., England, 15 mi. southeast of Gloucester, on the Churn River. Important historically as a

Roman post during their conquest of that country, it still has extensive ruins of that period in the neighborhood. Its present importance as a wool market had its inception in the 12th century as a *demesne* (see MANOR) of the Abbey of Augustin. The Royal Agricultural College is located in the vicinity and furnishes an impetus to the intense cultivation of that region. The chief industrial activity is in malting, brewing and the manufacture of cutlery. Pop. 1931, 7,200.

CIRQUE, an immense snowfilled amphitheatre in the mountain wall at the head of a valley glacier. These huge bowls, quarried out of the rock by the "plucking" action of the descending ice, serve as reservoirs, or feeders to the glacier. The knifelike aretes and sharp "horns" of the Alps result from the juncture of two or more cirques. Many high mountain lakes occupy cirques abandoned by the ice. Perfect examples of glacial cirques abound in the Rockies, Sierra Nevada, and other American ranges.

CIRRHOISIS OF THE LIVER, an increase of connective tissue of the liver. Excessive use of alcohol over an extended period is the usual cause ("whiskey drinker's liver"); because of the appearance of the uneven surface, the condition has also been designated "hobnail liver." The changes are due to an increase of the connective or supporting tissue at the expense of the parenchymatous or active liver cells. Male adults are mostly affected. In addition to alcohol, spices and bacterial poisons may be causative factors.

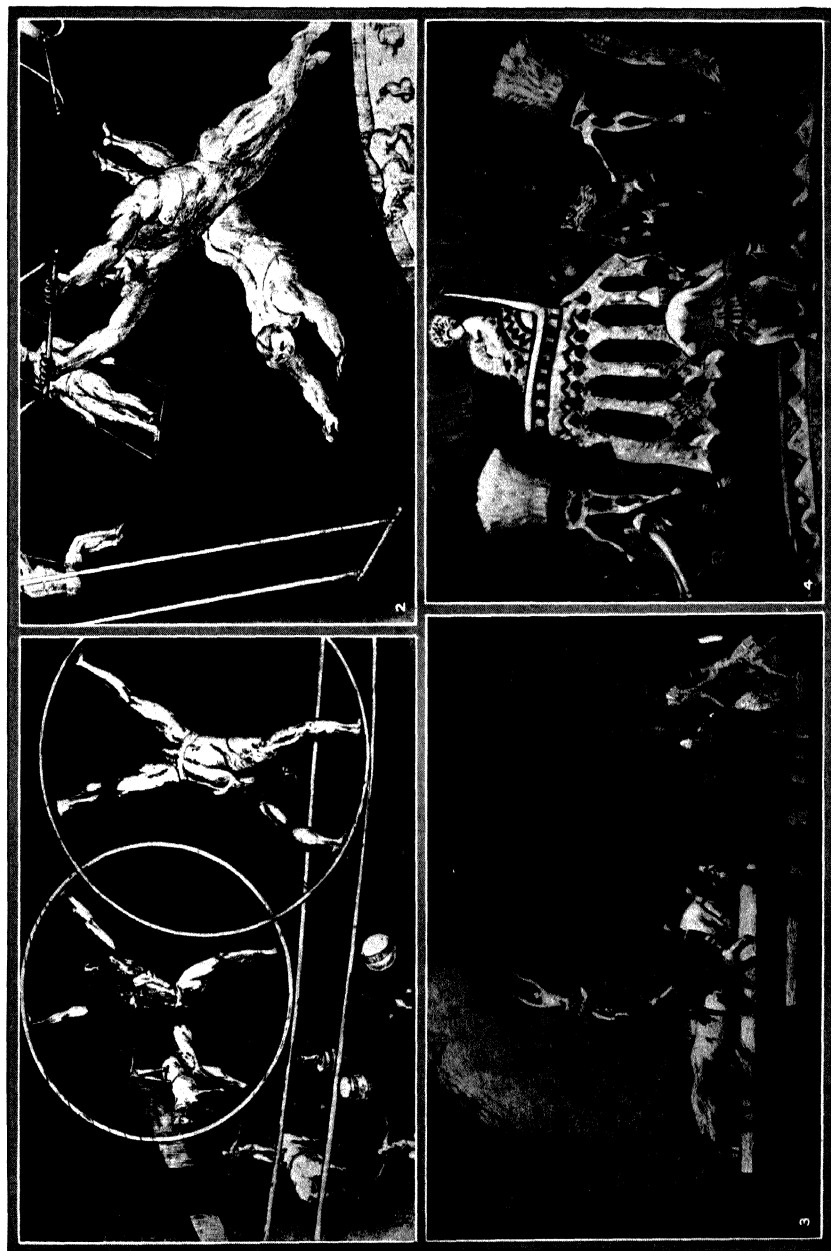
Early in the disease the liver may be larger than normal, due to excess fat; in later stages the organ shrinks markedly, becoming uneven, firmer, but still yellow from fat deposits. These alterations interfere with the circulation of blood in the liver, leading to stasis of blood in the abdominal vessels. The veins of the lower end of the esophagus, the rectum, stomach and intestines become distended and hemorrhage may occur.

Another feature is the accumulation of large quantities of free fluid in the abdominal cavity (ascites). The abdomen enlarges and tapping may be necessary to relieve the pressure. The patient gradually loses strength, and may become drowsy, delirious and towards the end unconscious. The condition is incurable, although the patient may live with the diseased liver for several years. I.P.

CIRTA, an ancient fortress-city in Numidia, of which it was the capital. It was demolished in 311, but was rebuilt by Constantine and named Constantina, from which the modern CONSTANTINE derives its name.

CISALPINE REPUBLIC, the state established in 1797 by a union of the Cispadane and Transpadane republics, established north and south of the Po by Bonaparte in 1796. The Cisalpine union had jurisdiction over Lombardy, Mantua, Bergamo, Brescia, Cremona, Verona and Rovigo, the duchy of Modena, the districts of Bologna, Ferrara and the Romagna, and the principalities of Massa and Carrara,

CIRCUS



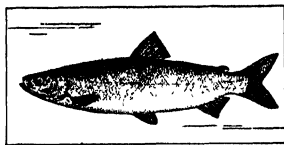
1, 2, COURTESY DOWNTOWN GALLERIES, NEW YORK; 3, 4, KRAUSHAR GALLERIES, NEW YORK

UNDER THE BIG TOP, THROUGH THE ARTIST'S EYES

1. "The Wheels," by Harry Sternberg (1904-).
2. "The Trapeze," by Harry Sternberg (1904-).
3. "Circus Ring, Hippodrome," by Gifford Beal (1879-).
4. "Grand Entry," by Gifford Beal (1879-).

an area of 16,000 square miles. In 1815 the territory became a part of Austria. It revolted in 1848 but was again subjugated by the Austrians and did not become free till after the Italian-French war against Austria in 1859.

CISCO, or lake herring, a fish closely related to the WHITEFISH, is found in large numbers in the Great Lakes, occurring also in the lakes of the northwestern states and in Alaska, Europe, and Asia. The cisco (*Leucichthys artedii*) abundant in the Great Lakes, has an elongate body covered with small scales and resembles the herring, but is not related to the marine herring family. Its coloring is blue-green



cisco (*Leucichthys artedii*)

above, with silver sides and white beneath. In the spring these fish leave the deep waters where they usually live, going to the shallow shoals in search of food. In the late fall they migrate to the spawning beds close to shore. Fishermen patrol the lakes with tugboats and gill nets in the spring and summer, catching great quantities of ciscoes, which are considered second only to whitefish in commercial and food value in this region. Anglers find getting them on a hook good sport. Ciscoes are small, weighing from 1 to 2 pounds, but they are voracious and cause much important loss because they feed heavily on whitefish spawn. A smaller cisco (*L. sisco*) inhabits the lakes of Indiana and Wisconsin, while another variety (*L. alascanus*) is found in Alaska near the Bering Straits.

CISCO, a city in Eastland Co., northern central Texas. It is situated 90 mi. southwest of Fort Worth and is served by three railroads. The city is a distributing center for live stock, corn, cotton and many other agricultural products. There are profitable oil fields in the vicinity and the city has oil refineries and a nitroglycerin plant. It is the seat of Randolph College. A state fish hatchery is located here. Pop. 1920, 7,422; 1930, 6,027.

CISPADANE REPUBLIC, a republican state in Italy established by Gen. Bonaparte in 1796, following the Battle of Lodi. Its territory embraced Bologna, Modena, Ferrara and Reggio, and derived its name from the Padus, or Po, the river dividing the Cispadane from the Transpadane republic. In 1797 the Cispadane was merged with the CISALPINE REPUBLIC.

CISSOID, a curve invented by Diocles, a Greek mathematician, about 100 B.C. Its equation is $y^2 = x^2/(2a - x)$, or $r = 2a \sin 2\theta \cos \theta$. See CURVES.

CISTERCIANS, members of the famous branch of the Benedictine order which was established in

1098 by St. Robert, abbot of Molesme at the then newly-erected abbey of Cîteaux, a village in the Department of Côte d'Or, 12 mi. from Dijon in France. For 200 years the Cistercians followed the Rule of St. Benedict in all its rigidity. Under the influence of St. BERNARD (1090-1153), one of its members, many monasteries were established and the most flourishing period in the history of the order was from 1134 to 1342. In 1152 there were as many as 350 Cistercian abbeys. After the 14th century the influence of the Cistercians declined until the end of the 18th century, when the order revived under the labors of Abbot de Rance (c. 1790), who restored the rule at La Trappe, but who, on account of the French Revolution, removed his headquarters to Val-Sainte in Switzerland, where the Cistercians became known as "Trappist monks." Colonies were established in Spain, Belgium, Piedmont and, in 1800, in France. In 1803, under the direction of Dom Urbain Guillet, the first colony came to America, where the Cistercians are still active in Maryland, Kentucky and Illinois. In 1902 the Trappist name gave place to the older designation of Cistercian, confirmed by Pope Leo XIII. Cistercians live a communal life and observe the rule of silence, unbroken except in emergencies permitted by the order or the superior.

CITHAERON, a mountain range dividing Bocotia from Attica and Megaris, in southeastern Greece. It extends east and west from Mt. Parnes to the Corinthian Gulf. Some of its peaks are over 4,600 ft. The modern name is Elatea because of its pine woods. It is rich in legend as the place where Dionysus held his secret festival, where Actaeon was changed by Artemis into a stag and killed by his own dogs and where the Bacchantes in a Bacchic fury tore Pantheus limb from limb. Platea, remembered as the scene of battle with the Persians, is on the north side of this range.

CITIZENSHIP, the chief source of nationality, and a term of municipal rather than INTERNATIONAL LAW. It signifies the possession within the state of full political and civil rights, within certain limits, such as age and sex. Sources of citizenship are by birth, either within a particular place (*jus soli*) or by right of blood (*jus sanguinis*), by NATURALIZATION, and by revolution. Under the 14th Amendment to the Constitution of the United States "All persons born or naturalized in the United States and subject to the jurisdiction thereof, are citizens of the United States, and of the state wherein they reside."

CITIZENS MILITARY TRAINING CAMP, a camp at which young men and boys not connected with any department of the service are given military training. Citizens military training camps are equipped with all the facilities and equipment of a regular service camp, and are generally located at an army training reservation. The camp is under the charge of members of the regular army and is held for a period of four weeks during the summer.

CITRANGE, a frost-resisting hybrid orange obtained by crossing the common orange (*Citrus sinen-*

sis) with the hardy trifoliate orange (*Poncirus trifoliata*). Although sparingly grown and not adapted to commercial culture, it is suitable for home cultivation in the cotton belt of the southern states where the weather is too cold for other citrus fruits. It has many forms with fruits differing widely in size, color and shape.

CITRIC ACID, one of the stronger organic acids, occurring in the fruit of all species of the *Citrus* genus, especially the lemon and lime. From these last two it is made on a large scale by boiling the purified juice with pulverized limestone, then treating it with sulphuric acid which precipitates the calcium sulphate; by evaporating the solution, the citric acid may then be obtained in colorless crystals which have a strongly acid, but agreeable taste. Chemically it is a tri-basic acid, of the formula $\text{COOH.CH}_2\text{C(OH)COOH.CH}_2\text{COOH}$, containing three carboxyl groups, and can be made synthetically from glycerine. The free acid is widely used in artificially prepared lemonades and other soft drinks; in making laxatives as magnesium citrate; and in calico printing, where its presence keeps iron and other metallic salts from precipitation by caustic alkali: combined iron-ammonium citrate is used as a tonic.

CITRINE, a yellow quartz cut and set in jewelry. True citrine of a clear, golden, champagne, or honey color, sometimes passes for topaz, though it lacks the hardness and brilliancy of that gem. Fine specimens command the price of amethysts. Citrine comes mainly from Brazil. Smoky-quartz, rendered yellow by heating, is sometimes called "citrine," "Spanish-topaz," or, if of the Scotch variety, "cairngorm."

CITRON (*Citrus medica*), the large, lemon-like fruit of small, thorny, evergreen trees of Asiatic origin, cultivated in Mediterranean countries and sparingly in California and Florida, for its thick, fragrant rind which in candied form is used in confections. The golden, slightly acid fruit follows showy white flowers. The sacred Etrog of Jewish Passover ceremonies is the unripe fruit of ungrafted citron-trees, imported from Palestine or Corfu. The round preserving citron is a hard, white-fleshed variety of watermelon. Citron rind, barreled in brine, is imported into the United States mainly from Corsica, and candied in this country.

CITROUS BELT, a name given that section of the United States where citrus fruits are grown. The territory comprises the southern three-fourths of California, all of Florida, and the southern portions of Georgia, Alabama, Mississippi, Louisiana, Texas and Arizona. California and Florida are the big producers. In 1929, California with 68% and Florida with 27% produced together 95% of the United States oranges. In the same year, Florida produced 70% of the grapefruit, California 14% and Texas 13½%; California produced the entire commercial crop of lemons.

CITROUS FRUITS, those of the genus *Citrus* of the family *Rutaceae*, consisting principally of oranges, lemons, grapefruit, limes and tangerines. There are

several of less importance, including kumquats and loquats. Production is confined to tropical and subtropical climates. The trees are evergreen; the blossoms are generally white, fragrant and ornamental. Orange blossom honey is a delicacy and a trade specialty.

Citrous fruits are usually eaten fresh or the juice and pulp are extracted for drinks. They are important sources of vitamin C and their use for children and invalids has rapidly increased within recent years. Grapefruit, known also as pomelo, is now canned extensively, making a satisfactory substitute for the fresh fruit. The canning of grapefruit juice is a new venture. These two enterprises are largely centered in Florida. Orange marmalade has a considerable sale, especially in Great Britain.

The chief sources of citrus fruits in the United States are Florida and California, with rapidly increasing production, especially of grapefruit, in southern Texas. Smaller quantities are grown locally in Arizona, Louisiana and Alabama. Imports of oranges and grapefruit are from Porto Rico and Cuba, with small quantities from Mexico. Sicilian lemons formerly dominated eastern markets, but are largely excluded by the tariff. California now produces most of the lemons used in the United States. The combined exports of grapefruit and oranges far exceed combined imports.

North European and British markets draw most of their oranges from Spain, some from the eastern Mediterranean, especially Jaffa, and increasing quantities from South Africa and the United States. The trade in grapefruit is new and growing; the United States is the chief exporter. Italy and Sicily supply Europe with most of its lemons and Sicily is also the chief source of lemon oil and citric acid. California has recently entered this field.

The areas suitable for citrus fruit production are very large, but both trees and fruits are attacked by so many diseases and pests that commercial production is limited to specially favored districts or to regions where scientific methods of disease and pest control are applied. Small quantities for local use and of variable quality are grown in nearly all tropical countries. In many countries the Mediterranean fruit fly has been found to be the limiting factor in profitable production. Immunity from this pest in the United States is a major reason for the tremendous growth of these industries.

Oranges, grapefruit and lemons reach edible maturity before turning yellow. Practically all lemons are picked when solid green and are colored by special treatment with heat and carbon dioxide gas. They may then be held in cold storage for months. Active demand is dependent upon warm weather. Almost all early shipments of oranges and grapefruit are colored by a similar but more rapid process. The skins turn yellow without affecting the pulp or juice.

Standardization for market and the machinery of distribution are highly developed in America. A citrus packing-house with machinery for coloring,

washing, brushing and drying the fruit requires an investment of many thousands of dollars. Subsequent distribution brings the fruit within reach of practically every American family. W. A. S.

CITY-COUNTY GOVERNMENT, a form of local government in which have been consolidated the functions of both city (*see* MUNICIPAL GOVERNMENT) and County. In England until recently when a borough reached a population of 50,000 it was usually made a county-borough. In Virginia all cities of over 10,000 are counties by themselves. Baltimore in 1851 was separated from the county of which it had been a part and made a separate city and county. Similar action was taken in San Francisco 1856, St. Louis, 1876, and Denver, 1903. In the case of Philadelphia, 1856 and New Orleans, 1874, the whole territory of the county was joined to the city to make a consolidated city and county. The chief advantage of city-county government is the avoidance of duplication of functions between the city and the county which is always very evident where a large city is situated in a county. Its chief disadvantages have been incompleteness (in Philadelphia and San Francisco, for example, several constitutional elective county offices remain entirely independent of the city government), and the inability in several instances of the remainder of the county from which the city-county was formed to maintain the services required in a county adjacent to a great city. Opposition of county authorities on this ground has led England to abandon making new county-boroughs. Furthermore, a separate city-county status is an obstacle to the normal growth of a city by annexation. Philadelphia, San Francisco and St. Louis have not grown since consolidation. T. H. R.

BIBLIOGRAPHY—*The Government of Metropolitan Areas*, National League, 1930.

CITY GOVERNMENTS. *See* MUNICIPAL GOVERNMENT.

CITY PLANNING. *See* TOWN AND CITY PLANNING.

CITY STATE, a sovereign state comprising the inhabitants of a single city, or a city and its immediate environs; a logical development from the tribal nation which flourished particularly in ancient Greece where citizens owed allegiance primarily to Athens, Sparta, or other Hellenistic towns, and only combined as Greeks in the face of an emergency. The governmental organization of these city states was usually pure DEMOCRACY. The size of the state made it possible for all the citizens to gather together in popular assembly. In later times city states were found in Italy and along the shores of the North Sea. However, as the territory around such cities grew in importance, and as increased communication with other independent groups demonstrated a community of interest, the city state tended to merge into the national state. Pure democracy became a physical impossibility, and the distinguishing characteristics of the smaller unit were subordinated to those of the larger group. S. C. W.

CIUDAD REAL, a city of south central Spain, capital of Ciudad Real province. It has remains of old walls, a city gate in Moorish style and a Gothic cathedral. Founded by Alphonse X in 1255 Ciudad Real became a city in 1420. It produces cloth, gloves, oil and flour, and deals in the agricultural products of the surrounding fruitful country. Est. pop. 1929, 18,000.

CIVET, or civet-cat (*Viverra*), a carnivorous quadruped whose scent-pouch near the genital organs in both sexes produces an oily, honey-colored substance called civet, used in perfumery. The claws are only partially retractile, the head and muzzle are elongated, and in proportion to the trunk the limbs are shorter than the cats'. It is the African civet, occurring as far south as the Gaboon on the west and Abyssinia on the east, that is most used for its secretion. Other civets inhabit southern Asia, East Indian Archipelago, Malacca and Formosa. The African civet approaches 3 ft. in length, without the ringed tail, and stands about 12 in. high. The color is smoky, marked with black stripes and spots in rows. The hair forms a crest along the spine. The civets that are caught and kept in confinement for their secretion are fed on raw flesh to increase the output. When the extraction is to be made, about twice a week, they are placed in cages so narrow that they cannot turn and bite. The scent-pouch is scraped with a wooden spatula. The chief trade in civet is done in Abyssinia. The name civet-cat is sometimes applied to the Cacomistle and the spotted SKUNK.

CIVIC CENTER, a group of important public or semi-public buildings, such as city hall, county court house, and municipal auditorium, arranged about a public square with some uniformity of architectural treatment.

BIBLIOGRAPHY.—R. Unwin, *Town Planning in Practice*, 1919.

CIVIL ENGINEER, one skilled primarily in the economical and adequate design of structures and their proper erection. He must have a knowledge of the properties and strength of all materials to the end that as assembled they are sufficient for the loads imposed upon them and will withstand the ravages of weathering. His work includes the provision of water supplies, the disposition of industrial and municipal wastes, the drainage of submerged land, the irrigation of arid land, the development of water-power, the maintenance of river channels for flood protection and navigation, the protection of shores and beaches from waves and currents, the construction of harbors and canals.

The civil engineer is employed as an expert to whom is entrusted the responsibility for specifying all details of a complete structure to perform a given function. His work may include all or any of the phases of an operation, including surveys of the physical conditions, the selection of site, the determination of the most economical type of structure, the selection of the most suitable kind of materials, the supervision of the manipulation of the materials and

the decision as to the equitable payment therefor. His work generally necessitates many assistants. The maintenance and operation of many completed works call for the continuance of civil engineers in executive and managerial capacities. G. T. S.

CIVIL LIST, a fixed annual income for the support of a monarch, his household and royal relations, usually made by a parliament at the beginning of a reign. In England the practice began in 1698. It is considered an indispensable institution of constitutional rule, in order to preserve the strict separation between royal and national public income. The total civil list of King George V, for himself and members of his family, was fixed by Parliament on recommendation of a Select Committee in 1910 at £576,000.

CIVIL RIGHTS BILL. (1) An act of Congress, 1866, designed to secure civil protection to the Negroes of the South against discriminatory state legislation, asserting their right "to make and enforce contracts, to sue, be parties, and give evidence, to inherit, purchase, lease, sell, hold and convey real and personal property, and to the full and equal benefit of all laws and proceedings for the security of person and property, as is enjoyed by white citizens." President Johnson, deeming the bill an unconstitutional restriction upon state authority, vetoed the measure after its first passage. His veto was overridden, but, fearing the repeal of the act when and if the Democratic party should return to power, Congress recast the act in the form of the Fourteenth Amendment. (2) An act, Mar. 1, 1875, long agitated by Senator Sumner and sponsored by Benjamin F. Butler, guaranteeing equal rights to Negroes in hotels, public conveyances and places of amusement, and in jury service. In 1884 the act was voided by the decision of the Supreme Court that the civil rights conferred upon the freedmen by the 14th Amendment did not comprehend social rights.

CIVIL RIGHTS CASES, 1883, five cases involving violation of the Civil Rights Act of 1875 (*see* CIVIL RIGHTS BILL), treated by the U. S. Supreme Court in a single decision declaring the act unconstitutional. Two of the cases arose from indictments for denying hotel accommodation to Negroes. One concerned the refusal of a railway conductor to allow a Negro woman to ride in the ladies' car. Two concerned the refusal of theaters to permit Negroes to buy tickets for choice locations. Justice Joseph P. Bradley, rendering decision on Oct. 15, 1883, stated that the acts complained of had nothing to do with slavery or involuntary servitude; that the Civil Rights Act was beyond the powers of Congress, the 14th Amendment having given no power to Congress to legislate on subjects within state legislative domain but having authorized only "corrective legislation . . . for counteracting the effect of state laws." Much of the work of the radical Reconstructionists to gain social equality for the Negro was undone by the decision.

CIVIL SERVICE COMMISSION, a commission organized on Mar. 8, 1883 under an act "to regulate and improve the civil service of the United States."

The commission of three, not more than two of whom can be of the same political party, assist the President in formulating suitable rules for carrying the act into effect. According to requirements set forth in the law, open competitive examinations are held for determining the fitness of applicants for posts in the classified service. Through local examining boards, the commission holds such examinations in the principal cities of the United States, Hawaii and Porto Rico. Appointments are made from among those passing with highest grades, after a period of probation and with due regard for apportionment of posts in the departments at Washington among the states and territories. Under other provisions of the act, investigations may be made in regard to enforcement of rules, and the penalty of fine or imprisonment or both is prescribed for any one in the service soliciting or collecting funds to be used for any political purposes. S. C. W.

BIBLIOGRAPHY.—*Report of the Civil Service Commission, 1931; Congressional Directory, 1931.*

CIVIL WAR, 1861-65, a conflict in the United States, between the northern, or loyal, states, and the seceding southern states. (*See* CONFEDERATE STATES OF AMERICA.) This war was the culmination of a political conflict extending from the dispute over admission of Missouri into the Union as a slave state, through the nullification movement in South Carolina, the annexation of Texas, the disposition of lands acquired from Mexico, the admission of Oregon, the Kansas-Nebraska Act, through the disintegration of the Democratic party organization in 1860. Coincidentally with the political conflict there had existed a sharpening demarcation of emotional differences extending from the practical disappearance of anti-slavery sentiment in the South in 1831, and the agitations of pioneering Abolitionist publications and speakers, through the nullification by popular sentiment of the fugitive slave laws in the North, the assault upon Sen. Sumner by Preston Brooks in 1856, John Brown's Raid, and the election of Abraham Lincoln to the presidency. Great fundamental issues were involved: the destiny of the public lands of the United States, whether in accord with the national public lands system which favored the common man, the small independent land owner, or in accord with the plantations system, the concentration of land in large tracts to be exploited by slave or contract labor; the commercial alliance of the farming areas of the Mississippi valley with eastern or with southern cities; and the constitutional problems of nullification and secession.

The strain of the diverging political theories between the increasingly democratic northern population and the landed aristocrat group who represented the South in national affairs, and of economic theories as the Industrial Revolution gained headway in the North while the capital of the South was concentrated in the production of "King Cotton" and a few other staples, reached the breaking point in 1861. Armed conflict was precipitated, after the national adminis-

tration had carefully avoided committing a *casus belli*, by the attack of the South Carolina military upon FORT SUMTER.

From Sumter to Malvern Hill, 1861-62. Pro-southern sentiment in the North was stilled at news of the bombardment, to be reasserted in the course of the war in the unsavory connotations of COPPERHEADS, KNIGHTS OF THE GOLDEN CIRCLE AND SONS OF LIBERTY. Lincoln on Apr. 13 issued a proclamation stating that the execution of the laws of the United States were being opposed in certain states by forces too powerful to be handled by ordinary judicial procedure, and calling for 75,000 militia to serve for three months in suppressing the opposition and reclaiming the seized properties of the United States. The South construed the proclamation as a declaration of war; Jefferson Davis issued a call for volunteers, invited applications for privateering commissions, despatched commissioners to Europe to secure recognition of the independence of the Confederacy, and convoked the Confederate Congress to enact the necessary legislation. The South had the initial advantage: the Secretaries of War and the Navy in Buchanan's cabinet, Southern sympathizers, had dispersed the Federal army and navy to remote points, and had transferred arms and other equipment from northern to southern arsenals; the Confederates had possession of the arsenal at Harper's Ferry and the navy yard at Norfolk, where they had seized 2,000 cannon; a large proportion of Federal army officers, including Robert E. Lee, had resigned to assume commands in the Confederacy.

On Apr. 19, the day on which Lincoln declared a blockade of southern ports, the Sixth Massachusetts Regiment while crossing the city of Baltimore to en-train for Washington was attacked by a mob; four soldiers and nine citizens were killed. Vigorous exercise of Federal authority quashed secessionist sentiment in Maryland; wire and rail communications between Washington and Philadelphia were restored. In Missouri secessionist forces were defeated at Boonville; their later success at Wilson's Creek proved of no effect, and although thousands of Missourians joined the Confederate army and others engaged in guerilla warfare against loyal settlements, the state remained in the Union. The secessionist governor of Kentucky was opposed successfully by a loyal legislature. A sovereignty convention at Russellville passed an ordinance of secession and elected a provisional government, but these proceedings were farcical in the face of the occupation of the state by Federal troops. Meanwhile the first battles between the regular armies in Virginia had been fought at Big Bethel, June 10, and Manassas, July 21; and Gen. McClellan in western Virginia had defeated Confederate forces in the Battle of Rich Mountain, July 11, and other engagements. The result to that region was the creation of the state of West Virginia, and to McClellan his appointment as commander-in-chief of the Army of the Potomac.

The rout of Federal troops at Manassas, one week

after Congress had convened to vote troops and men, roused the North to the gravity of the struggle; before its adjournment, Aug. 6, Congress had placed the nation on a military footing, and had invested the president with extraordinary powers. All Lincoln's acts, proclamations and orders, including the suspension of habeas corpus, were legalized by retroactive resolution; the raising of 500,000 volunteers was authorized; all property used or intended to be used in aid of the rebellion was declared open to confiscation by presidential order, and slaves so used were to be emancipated. Secretary of the Treasury Salmon P. Chase was authorized to contract loans aggregating \$250,000,000, giving bonds and interest bearing notes. Internal taxation, a three per cent levy on incomes, and increases in customs duties were voted to add some \$30,000,000 to the annual revenue. Every northern town and village bustled with military activity; Jay Cooke and other financial agents easily placed the first Treasury flotations at favorable rates. The Confederacy in the absence of domestic manufactures could raise only insignificant revenue from internal taxation; anticipated revenue from export duties on raw materials vanished as the Federal blockade of southern ports became effective. The first taxation measure of the Confederate Congress was a direct tax of \$20,000,000 apportioned among the states, and met, with the exception of Texas, by the issuance of state bonds or notes. Loans raised by Secretary of the Treasury C. C. Memminger to an authorized amount of \$15,000,000 early in 1861 drained most of the specie holdings of the southern banks. Debts owed northern creditors were confiscated by an enactment that such debts should be paid only to the Confederate government, which gave certificates to be cashed in specie at the end of the war; the Act of Aug. 30, 1861 confiscated the property of alien enemies and appropriated the proceeds to indemnify those who had suffered at the hands of Federals. Paper currency, bearing interest, was first issued in Mar. 1861; quantities followed bearing no interest, redeemable at specified periods after the end of the war. The rising flood of paper currency soon drove coin quite out of circulation.

The region about and below the confluence of the Ohio and the Mississippi became the first scene of sustained action. In the Federal campaign to reduce the chain of Confederate posts stretching westward from southern Kentucky, free the Unionists of eastern Tennessee from Confederate control, and move toward the core of the Confederacy, the future commander of the Union armies, Gen. U. S. Grant, rapidly gained reputation. The successive Federal victories at Belmont, Ft. Henry, Ft. Donelson, Pea Ridge, New Madrid, Shiloh, and Island No. 10 attained the first two of these objectives, paved the way for the third, and, completed by Admiral Farragut's success at New Orleans, Apr. 25, 1862, closed the Mississippi to Confederate use and isolated Texas from the remainder of the Confederacy. In the previous month the famous duel between the vessels MONITOR and MERRIMAC had

eliminated the Confederate vessel and committed the United States to a program of extensive construction of ironclad ships. The Army of the Potomac had not yet begun an active campaign. Defeat at Ball's Bluff marked McClellan's single deviation from his concentration upon organizing and drilling the army until, on Feb. 22, Lincoln took up the popular demand and ordered a forward movement. In lieu of a directly overland movement against Richmond, which Lincoln favored, McClellan transported his army of 121,500 men to the apex of the peninsula formed by the James and York rivers. Established here, he was still dilatory, and did not fight until May 5. (See WILLIAMSBURG.) The Peninsula campaign ended after Winchester, Seven Pines—Fair Oaks and the Seven Days' Battles and the Malvern Hill assault, July 1, with the Union army within 10 miles of the Confederate capital; but McClellan had lost more than 15,000 men, besides great quantities of arms and stores, and his plans for a new campaign against Richmond were countermanded by orders from Washington that he return with his army to the vicinity of the national capital.

Campaigns After McClellan's Removal, 1862-63. Gen. Pope was summoned to command the Union armies on the Rappahannock and in the Valley of Virginia. Another who had distinguished himself in the western campaign, Gen. Halleck, on July 11 supplanted McClellan as general-in-chief. Pope's immediate task was to lighten the pressure on the Army of the Potomac by threatening the Virginia Central Railway; Lee met the diversion with a counter offensive. After the defeat of a Union army at Cedar Mountain, Pope retreated from the Rapidan to the Rappahannock. Mystified by the rapid movement of Gen. Jackson's Confederate forces, Pope allowed the forces of Jackson and Lee to unite and was defeated in the second battle of Manassas, Aug. 29-30. The Federal force retreated to the fortifications of Washington. Lee planned an invasion of Maryland, to influence the approaching Congressional elections in the North, detach Maryland from the Union, and reinforce the Confederacy's demands for recognition by foreign powers. Jackson made a successful sortie upon Harpers Ferry; but McClellan, given his old assignment after Halleck had proved valueless, discovered the Confederate plans, thwarted Lee at South Mountain, and on Sept. 17 defeated Lee at Antietam. Lincoln seized upon the occasion to issue the EMANCIPATION PROCLAMATION. McClellan, exaggerating the enemy's strength, delayed more than a month before recrossing the Potomac into Virginia in pursuit of Lee, and was removed in favor of Gen. Burnside. In the West Confederate offensive movements were also checked. Confederate armies led by Bragg and Kirby Smith invaded Kentucky for political effect, but after an accidental, indecisive encounter at Perryville retreated into eastern Tennessee. Meanwhile Gen. Rosecrans, Pope's successor under Grant, who was now general-in-chief of the Army of the Tennessee, defeated the enemy at Iuka and Cor-

inth. Deferring his advance against the main Confederate force, under Gen. Bragg, until he had accumulated a large reserve of rations at Nashville, Rosecrans advanced late in December, ejected the Confederate army from Murfreesboro, and there established winter quarters, 1862-63.

Gen. Burnside, renewing the Federal offensive in Virginia, decided to cross the Rappahannock at Fredericksburg and march directly against Richmond; but delay in the forwarding of a pontoon train from Washington permitted Lee to entrench his Confederates behind the hills of Fredericksburg. None the less Burnside rashly crossed, and the Union army suffered great losses on Dec. 13. The two armies passed the winter facing each other across the Rappahannock. Gen. Hooker, succeeding Burnside, Jan. 26, quickly restored the shaken morale of the Army of the Potomac, and, obedient to instructions from Washington to concentrate upon Lee's army rather than upon Richmond, crossed the Rappahannock to assume the offensive. At Chancellorsville, May 1, 1863, and related engagements Lee exhibited consummate generalship, and, self-confident, overruled the advice of Gen. Longstreet, his closest lieutenant, that he leave Virginia and march with part of his army to the relief of Vicksburg. He decided to invade Pennsylvania, hoping in particular to levy supplies from a free state and to prevent the sending of Federal reinforcements to Gen. Grant in the West. An advance division under Gen. Ewell captured Winchester and preceded Lee into Pennsylvania. Gen. Meade, succeeding Hooker in command of the Army of the Potomac, moved with celerity, and at Gettysburg, July 1-3, checked Lee's invasion, and followed the Confederate army in its retreat as far as Culpeper.

In the West Grant's plans for the capture of Vicksburg, laid in the autumn of 1862, matured with the surrender of the city on July 4, 1863. The fall of Fort Hudson five days later completed the cleavage of the Confederacy. At the news of Grant's success Gen. Rosecrans, in the middle of Tennessee, took the offensive. In the Battles of Chickamauga, Chattanooga, Lookout Mountain, Missionary Ridge, and the SIEGE OF KNOXVILLE the Union armies completely demoralized Gen. Bragg's Confederate forces and shattered the last links in the chain of Confederate posts in the West. The lower South was now accessible to Federal operations.

Finances, North and South. Financial exigencies overrode the original reluctance of Secretary of the Treasury Chase to issue fiat currency; the Act of Feb. 25, 1862 authorized the first issue, \$150,000,000, of greenbacks, and by the close of the war \$432,687,000 in this paper currency was outstanding. A loan of \$500,000,000 was floated with fair success in 1862, despite the fact that the interest rate was unsatisfactory to investors and that the legal tender notes were convertible into bonds. The Act of Mar. 3, 1863 authorized the Secretary to contract loans of hitherto unprecedented volume; by May of that year the soldiers had been fully paid and all necessary requisitions

upon the Treasury satisfied. The aid of Jay Cooke & Co. was largely instrumental in these later flotations, in denominations small enough to be within the reach of the middle classes. Duties on imports were increased beyond the provisions of the original MORRILL TARIFF ACT until by the close of the war the average on dutiable articles was 50%. The vital Act of July 1, 1862 established an extensive machinery of internal taxation. The nation was divided into districts roughly corresponding to the congressional districts, in each of which an assessor and a collector were appointed with adequate powers of inspection and seizure; George S. Boutwell was general commissioner. From distilled spirits, wines and beers, and tobaccos came the largest revenue; but all manufactures were taxed. The protective tariff, however, removed the confiscatory possibilities from this taxation. Whereas the annual increase of wealth during the war years was about \$550,000,000, internal revenues reached in 1866 nearly 60% of that figure. The stabilization of national finances owed much to the Act of Feb. 25, 1863, establishing the system of national banks which has prevailed without major modifications until the FEDERAL RESERVE ACT of 1913. One-third of the capital of each national bank had to be in United States bonds, against which reserve the comptroller prepared for the bank circulating notes to the amount of 90% of its deposit. An act of 1865, levying a 10% tax on the circulation of state banks, forced such institutions to abandon their note-issuing function. Beyond its significance in establishing financial security, the system bound the citizens of the national government by ties of self-interest.

The Confederacy meanwhile floundered in a morass of unsound finance. By the autumn of 1863, \$1,000,000,000 in irredeemable currency was outstanding, at the prevailing exchange worth only one-nineteenth of the sum in gold. The individual states and other public bodies issued additional millions of irredeemable currency. The circulation of United States money in the Confederacy became ominously common; an act of Feb. 6, 1864 prohibited its circulation. The bonds of the Confederacy, purchased with paper money and paying interest in script, were quoted at approximately the value of the paper currency. During 1863 a tithe of agricultural products was exacted, although collectors met insuperable difficulty in several states; and subscription for bonds in cotton, tobacco and food products was authorized. Emil Erlanger, representing a French banking house, in 1863 negotiated a loan of \$15,000,000 in bonds redeemable in cotton six months after the conclusion of peace. Most of these were taken in England, and about \$6,250,000 was realized by the Confederacy on the transaction. As loans and emissions of currency increased, probably not even the Confederate treasury knew the exact amount outstanding. Earlier issues of paper money were practically repudiated by an act of Feb. 17, 1864, which allowed them value only if exchanged into bonds by a system of compulsory funding, but by the close of the war over \$1,000,000,000 in paper cur-

rency was in circulation. Prices for products were often fixed by legislative fiat, and supplies for the army were raised by impressment at arbitrary valuations.

Grant, Sherman and Sheridan, 1864-65. Gen. Grant, elevated to command of all the Federal armies, Mar. 9, and given *carte blanche* by Lincoln, assigned Gen. Sherman to head operations in the West, and retaining Meade in active command attached himself to the Army of the Potomac. His plan contemplated continuous hammering by concentrated Union forces against the two largest armies of the Confederacy: Meade against Lee, Sherman against Johnston, a plan made practicable by the irreplaceable depletion of Southern man-power. Crossing the Rapidan on May 4, Grant and Meade began a bitter, costly campaign; the battles of the Wilderness and Spotsylvania were attended by frightful carnage on both sides, and, in assaulting the Confederate army in its entrenchments at Cold Harbor, Grant made the greatest mistake of his military career. A projected diversion, the advance of a Federal force up the south bank of the James toward Richmond, was nullified at Petersburg by the ineptitude of the Federal commander, Gen. Butler. Grant's ensuing siege of Petersburg was never a complete investiture. His aim to gain possession of the railroads south and southwest from Petersburg and Richmond had not been fully realized by the close of 1864. The only Federal successes in the East during the year were those of Gen. Sheridan, despatched by Grant in August to remove from the national capital the menace of Gen. Early's Confederate force in the Shenandoah valley. *See also WINCHESTER, BATTLES OF; COLD HARBOR, BATTLE OF; CEDAR CREEK, BATTLE OF.*

Gen. Sherman, commanding three armies under Generals Thomas, Schofield and McPherson, on May 5 started from Chattanooga on his long march into the lower South. The opposing Confederate force, under Gen. Johnston, fell back toward Atlanta, skirmishing throughout its retreat. Johnston's entrenchments on Kennesaw Mountain were assailed unsuccessfully; but the Confederate army, out-flanked, retired within the defenses of Atlanta. At this juncture President Davis erratically removed Johnston in favor of Gen. Hood; after several futile counter-attacks Hood abandoned the city. Concurrent naval activity, marked by the depredations of the British-built Confederate ship *Alabama*, was climaxed by the duel between the *ALABAMA* and *KEARSARGE*, June 11; and on Aug. 5 Farragut's fleet captured the Confederate forts commanding Mobile Bay. Defeatist sentiment in the northern states was checked by the victories of Generals Sherman and Sheridan and Admiral Farragut, and in the presidential election of November Lincoln won against Gen. McClellan, the Democratic candidate.

On Nov. 15 **SHERMAN'S MARCH TO THE SEA** was begun from Atlanta. To Gen. Thomas was assigned the task of checking Hood's Confederates from possible pursuit of Sherman's troops; handicapped by insufficient strength, Thomas profited by Hood's in-

ability to collect supplies readily. Federal reinforcements under Schofield withstood Hood's attack at Franklin and joined Thomas at Nashville; here, where Hood rashly followed, the Confederate army of the West was practically destroyed in the most decisive battle of the war. Sherman concluded his 32 days' march with the easy capture of Savannah, and a few weeks later, on Feb. 1, 1865, started northward to participate in the final campaign of the war.

The last Confederate port had been closed with the capture of FORT FISHER; yet at the HAMPTON ROADS CONFERENCE President Davis's instructions to the Confederacy's representatives involved impossible demands which left no solution to the war but the crushing of Lee's army. Sherman occupied Columbia, secured the evacuation of Charleston, which for four years had withstood the bombardments of the Federal fleet, by the mere presence of his troops in the vicinity. Gen. Hardee's Confederates, having left Charleston and attempting to join Johnston's new command in North Carolina, were defeated at Averysboro, and Sherman at Bentonville defeated Johnston. Lee made a desperate and unsuccessful assault upon FORT STEDMAN; trying to escape by way of Five Forks, he encountered Sheridan and was routed. Next morning, Apr. 2, a general assault was made upon Lee's entrenchments, and after stubborn and futile resistance the Confederate army began the retreat from Petersburg. Richmond was occupied by Federal troops the following day. Forced by Gen. Sheridan from the Danville Road to the north bank of the Appomattox River and surrounded by Federal armies, the Confederate army was surrendered by Lee at APPOMATTOX COURT HOUSE on Apr. 9. The capitulation of the other armies of the Confederacy was concluded by May 26.

The most authoritative estimates place the aggregate personnel of the Union army and navy during the war at 2,213,365 men. Reducing the numbers to the standard of three years' enlistment per man, there were in the Union forces 1,556,678 men, and by the same standard 1,082,119 men in the Confederate forces. In comparative field strength at any given time, the superiority of the Union forces was in excess of the proportion of the aggregate figures just quoted. Of the Union enlistments, 178,000 were whites from the slave states, and 99,000 were Negroes. The success of the draft in the North may be more exactly stated: 206,678 men were drafted, of whom 43,347 entered service, 86,724 paid commutation, and 73,607 furnished substitutes. In the Union army 67,058 men were killed in battle, 43,012 died of wounds, 224,586 of disease and 24,872 from accidents and other causes. The records of the Confederacy are too incomplete to permit authentic statements; probably about 95,000 men died in battle and about 164,000 from disease, accidents and other causes. The public debt of the United States on Jan. 1, 1866 was approximately \$2,773,000,000; the entire cost of the war to the nation could hardly have been less than \$10,000,000,000, exclusive of southern expenditures and losses. While the

people of the South were required to pay their share of the national debt, the debts incurred by the Confederate government and southern state governments during the Confederacy were cancelled by repudiation or by the adoption of the Fourteenth Amendment to the Federal Constitution. (See also separate articles on the important battles of this war, and ARMY, U. S., MEDICAL SERVICE.) E. D. B.

BIBLIOGRAPHY.—*The War of the Rebellion, Official Records of the Union and Confederate Armies*, 130 vols., 1880-1902, and the complementary *Official Records of the Union and Confederate Navies*, 20 vols., 1894-1905, are the most valuable of several official compilations. Frank Moore, *Rebellion Record*, 1865, and R. U. Johnson and C. C. Buel, *Battles and Leaders of the Civil War*, 4 vols., 1884-87, are documentary collections of a less formal sort. The best general histories are J. F. Rhodes, *History of the Civil War*, 1917, E. Channing, *History of the United States*, Vol. VI, 1925, and W. G. Shottwell, *The Civil War in America*, 2 vols., 1923. On military and naval administration and campaigns, see E. S. Maclay, *History of the United States Navy*, 2 vols., 1894; T. L. Livermore, *Numbers and Losses of the Civil War in America*, 1901; A. H. McNeeley, *The War Department, 1861*, 1928, F. A. Shannon, *Organization and Administration of the Union Army, 1861-1865*, 2 vols., 1928; and biographies of commanders, among which W. E. Woodward, *Meet General Grant*, 1928, and B. H. Liddell Hart, *Sherman*, 1929, are notable. Evelyn Scott, *The Wave*, 1929, is a remarkable imaginative reconstruction which may be compared with J. B. McMaster, *History of the People of the United States during Lincoln's Administration*, 1927. J. K. Hosmer *The Appeal to Arms and Outcome of the Civil War*, both 1907, together offer a general résumé supplemented by bibliographical notes.

CLAIRAUDIENCE, the power to hear sounds or voices purporting to emanate from spirits far beyond the range of human hearing. It is a term, like **CLAIRVOYANCE**, arising from the general belief that some persons possess supernormal sensory gifts. It may take the form of hearing voices of warning or prophesy.

CLAIRTON, a city in Allegheny Co., southwestern Pennsylvania. It is situated on the Monongahela River, 20 mi. southeast of Pittsburgh and is served by three railroads and by river craft. The city is an important industrial center, producing structural iron, steel products and by-products of coke. Eight million tons of coal annually support the coke products plant. The retail trade in 1929 amounted to \$3,575,628. There are coal mines and gas wells in the vicinity. Dairying and farming are carried on in this region. The city came into existence through the consolidation of the boroughs of Clairton, North Clairton and Wilson in 1922. Pop. 1920, 6,264; combined with other boroughs, 10,777; 1930, 15,291.

CLAIRVOYANCE, the power to see far beyond the range of human vision, to see into the future, or in retrospect, to live again the experiences of a remote past. It is the most common form of the belief in the gift of supernormal sensory powers, and is popularly called second sight. Clairvoyance was attributed to prophets, sybils and oracles of old.

In the period following Mesmer, the so-called somnambules in the trance state diagnosed disease by this power. Swedenborg is reported to have given an account of a fire many miles away which he saw clairvoyantly, thus supporting his religious revelations.

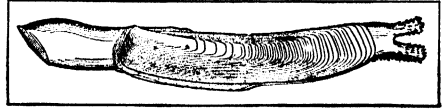
Spirit mediums in SPIRITUALISM were credited with this power, including that of reading sealed messages. Later, when the doctrine of TELEPATHY was advanced, the transmission was regarded as a mental rather than a super-sensory process. All such terms designate a possibility and do not imply the reality of what is defended by evidence which may range from credulous acceptance to scientific inquiry.

CLAM, the popular name of many mollusks whose shells are composed of two valves, that may be closed tightly together to protect the animals inside. The term clam is derived from clump. The valves are closed by a powerful hinge. They are usually parted a little to allow the animal to travel or to feed or to take in fresh water for respiration. The clam feeds on minute organisms, which it obtains from the water that passes constantly through two siphons at the rear of the body, in at one end and out at the other.

In locomotion a muscular tongue-shaped hollow foot is thrust forward into the bottom sand or mud. Its tip is expanded to get a good hold, and then when it contracts, the body is drawn forward. Thus by a succession of little pulls it travels with proverbial slowness, leaving a v-shaped groove as a trail to rearward as it goes. The clams do not form a family from the scientist's point of view, but as members of the class of bivalve mollusks (*Lamellibranchia*) they are closely related.

The best-known American species are two delicious edible clams, the quahog or hard clam (*Venus mer-*

painted clam (*Callista gigantea*) found on the southern coasts, and the geoduck (*Glycymeris generosa*) used by the Indians of the Northwest. A number of



RAZOR CLAM
Ensis americana

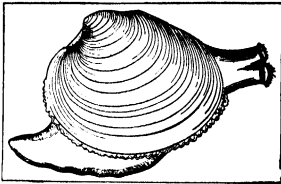
different edible clams are native to California's shores, but none are so popular as the familiar Atlantic species, which have been successfully established there.

In 1929 the commercial catch of clams taken on the coasts of the United States amounted to 20,198,000 lbs. with a value of \$3,917,000. This total included hard clams, 8,128,000 lbs. valued at \$2,530,000, and soft clams, 9,798,000 lbs. valued at \$1,072,000. See also GIANT CLAM; MOLLUSCA; SHELL-MONEY; WAMPUM.

CLAN, the name given by American anthropologists to a kinship group which reckons descent through the mother. It consists of a woman, her children, her daughters' children, her daughters' daughters' children and so on, in the female line. Clan members are generally forbidden to marry inside the clan. The woman's sons, therefore, take wives from other clans and their children belong to these other clans, since they will reckon descent through their mothers. Children, under the clan system, bear the clan name of their mother. They fight with the mother's clan and meet with it on all important occasions while the father leaves them to join his own clan. Other names for clan are matrilineal sib and mother sib. See also DESCENT.

CLAN-NA-GAEL, an organization of Irish-Americans which was Fenian and revolutionary in its policy. It had its inception in Manchester in 1867 when Republicanism was reinvigorated after the failure of the attack on British power in Ireland and in Canada. The clan, with headquarters in New York, published the *Gaelic American* under the editorship of John Devoy and kept in close contact with the Irish Republican Brotherhood. It was an organization "to which no appeal for money for any object even remotely separatist was ever made in vain." (P. S. O'Hegarty, *The Victory of Sinn Fein*.) The Clan-na-Gael contributed to the Catalpa expedition to Australia which freed six of the rebels of 1865. It negotiated with Count von Bernstorff, German Ambassador to the United States, in 1914, supported Casement in his visit to Berlin, helped finance the Easter Rebellion of 1916 and defrayed the expenses of Casement's trial for treason.

CLARA, ST. (1194-1253), foundress of the Franciscan nuns, was born the eldest daughter of Count Sasso Rosso of Assisi, Italy, on July 16, 1194. When only 18 she was influenced by the preaching of St. Francis to leave her father's palace and, dressed in sackcloth, to minister to the poor. She adopted the



HARD-SHELL CLAM OR QUAHOG
Showing foot, siphons, and edge of mantle extended

cenaria) and the mannosose or soft clam (*Mya arenaria*). The hard clam is a native of the Atlantic coast, where it is found from Cape Cod to Florida, and also around New Brunswick, in water from 6 to 36 ft. deep. It is caught either with rakes or by dredging. Little neck clams, considered great delicacies, are young hard clams. The Indians made their most valuable dark wampum from the heavy shells of hard clams.

The soft clam, which lives on both sides of the Atlantic, is usually found between the tide marks. Soft clams bury themselves in the sand, but maintain contact with the world by their siphons. When the tide is out their presence under the wet sand is thus often betrayed by little holes, and they can easily be obtained by digging.

Other American edible clams are the beach, surf or hen clam (*Spicula solidissima*) of New England, the

Franciscan habit in 1212, and later entered the convent of St. Damiano, where she was abbess for 40 years. Her sisters, and after her father's death her mother, joined her. Her rule was approved by the pope two days before her death at Assisi, Aug. 11, 1253. She was canonized by Alexander IV in 1255.

CLAREMONT, a town and educational center, in Los Angeles Co., southern California. It is situated 37 mi. northeast of Los Angeles and is served by the Santa Fé and the Southern Pacific railroads. Claremont is the seat of Pomona College, Scripps College and Claremont College. Citrus fruit growing is the chief interest of the town and vicinity. Claremont was founded in 1886, by the Santa Fé Railroad, and was incorporated 1907. Pop. 1920, 1,728; 1930, 2,719.

CLAREMONT, a town of southwestern New Hampshire, in Sullivan Co., 55 mi. northwest of Concord. It is served by the Boston and Maine railroad. Claremont manufactures mining machinery, shoes, cotton and woolen goods, and paper. In 1929 manufactures were valued at \$11,838,378; the retail trade was \$4,889,562. The town is a trading center for dairy and farm produce. Pop. 1920, 9,524; 1930, 12,377.

CLAREMORE, a town in northeastern Oklahoma, the county seat of Rogers Co. It is situated 28 mi. northeast of Tulsa and served by bus lines and two railroads. Claremore is a wholesale trade center in a cotton and wheat growing region. The town is a health resort with valuable radium springs. It is the seat of a Federal Indian Hospital and the Oklahoma Military Academy. Claremore was named for a chief of the Osage Indian tribe who was killed here in a battle with the Cherokees about 1885. Pop. 1920, 3,435; 1930, 3,720.

CLARENDON, EDWARD HYDE, First Earl of (1609-74), English historian and statesman, was born in Wiltshire, Feb. 18, 1609. He was educated at Oxford, and took his seat in the Short Parliament of 1640. After the battle of Naseby in 1645, he was among those nobles appointed to look after the safety of the Prince of Wales. He passed two years in Spain then went to Paris, living with the royal exiles there in what was almost poverty. At the Restoration Clarendon at once assumed the direction of the government, but in spite of his abilities was unpopular because of certain repressive measures such as the Clarendon Code passed by the Cavalier parliament, the Conventicle Act and the Five-Mile Act. The marriage of his daughter to the Duke of York was not received with favour. He fell from the king's good graces, was forced to resign the chancellorship in 1667, was impeached and went to France. Here devoted to literature he spent the rest of his life. Cold and arrogant toward his equals, he was reverential to the king and the royal family, and a staunch champion of the established church. He died at Rouen, Dec. 9, 1674.

CLARENDON, CONSTITUTIONS OF, formed a codification of decrees imposed upon the English clergy by Henry II in 1164 as a step in his struggle to curb the power of the Church. Of the 16 provisions

of the constitutions several merely reaffirmed agreements made by Anselm with Henry I. And of the important new clauses only one survived as part of the permanent law of England, the provision that suits concerning advowsons, or the right of presentation of clergy, should be tried by a civil court, even when the suit lay between two clerics. Two other vital provisions which would have crippled ecclesiastical power were not long in effect. These provided that there could be no appeal to Rome without royal license, that the King's ministers and tenants-in-chief could not be excommunicated without the King's consent, and that clerics accused of crime were to be examined by a civil court before trial by an ecclesiastical tribunal and that if convicted by the latter they were to be sent back to the civil court for sentence. Following the murder of THOMAS À BECKET, Archbishop of Canterbury, in 1170, public opinion turned so strongly against the King that he was forced to renounce the constitutions in Sept. 1172.

CLARENDON CODE. This term is applied to four acts passed by the first Parliament of Charles II to secure the ascendancy of the established Church and the CAVALIERS over the Puritan nonconformists. The Corporation Act, 1661, required all municipal office holders to take the oaths of allegiance and supremacy, to renounce the Solemn League and Covenant, and to declare it unlawful to take arms against the King. The Act of Uniformity, 1662, required the clergy to use the Book of Common Prayer, and deprived of their benefices all ministers who did not receive Episcopal ordination. The Conventicle Act, 1664, forbade for three years any meeting of five persons or more, other than those of the same household, for any religious services except those of the Church of England. The Five Mile Act, 1665, prohibited the ejected ministers from going within five miles of any corporate town or of their former parishes.

CLARES, POOR, female religious members of the Order of St. Clare, sometimes called the Second Order of St. Francis. They are variously designated as Clarisses, Franciscan nuns or Minoreesses. The Order was established at Assisi in 1212. To-day it has about 600 houses and 12,000 members scattered in convents in Italy, Palestine, Yugoslavia, Germany, Holland, Belgium, Ireland, England, France, Spain, South America, Canada and the United States, which last the Poor Clares entered in 1790. Their rule requires fasting at all times except at Christmas and their habit is a loose garment of grey frieze, girdled by a linen rope, in which are four knots representing their vows.

CLARET. See BORDEAUX.

CLARINDA, a city in southwestern Iowa, the county seat of Page Co., situated near the Nodaway River, 80 mi. southeast of Council Bluffs. Bus lines and the Chicago, Burlington and Quincy Railroad afford transportation. There is a private landing field. Grain is the outstanding product of the region. The chief manufactures are washing machines, lawn mowers, and machinery for artesian well digging.

Clarinda was founded about 1853 and incorporated in 1866. Pop. 1920, 4,511; 1930, 4,962.

CLARINET (often miscalled clarionet), a single-reed wood-wind musical instrument that developed from the ancient shawm or chalumeau. Various mechanical improvements have been made in it from time to time, but its general characteristics and construction were established by Gustav Denner in 1690. Mozart was the first noted composer to make consistent use of it in his scores; since then it has been regarded as an indispensable member of every ORCHESTRA. Its compass is great, extending from *c* to *c'''* (see OCTAVE for an explanation of this nomenclature), and its tone color highly varied: rich and throaty in the lowest register, called the chalumeau, limpid in the lower middle register, more penetrating in the upper middle register, and extremely bright and shrill in the highest register. Physically viewed, it is a cylindrical wooden tube about 2 feet in length, terminating at one end in a bell and at the other in the mouthpiece furnished with a single reed. The tube proper is perforated by 18 holes, 13 of which are opened and closed by means of keys, the remaining 5 holes being manipulated directly by the player's fingers.

Performance upon it is unusually difficult, although in the hands of a skilled player it has great agility. In order to facilitate performance, clarinets are made in various keys, those in B \flat and A being the most common. These are what musicians call transposing instruments yielding tones different from the written notes. The clarinet in A, for example, produces a tone a minor third lower than the note written; consequently, in order to produce any given tone a note a minor third higher must be written for this instrument.

CLARISSA HARLOWE, the heroine of a novel of that name by SAMUEL RICHARDSON, published 1751. She is an innocent young woman of a good country family who, eloping with the dashing profligate Lovelace, dies of shame when she finds her reputation irretrievably compromised by her lover.

CLARK, ALVAN GRAHAM (1832-97), American astronomer and manufacturer of astronomical instruments, was born at Fall River, Mass., July 10, 1832. His father, Alvan Clark (1804-87), originally a painter and engraver, had turned to the manufacture of astronomical telescopes in 1836, producing the most powerful then developed, with which he discovered the companion star of Sirius. Clark continued in his father's work, building the 26-inch lens for the Naval Observatory at Washington, D.C., a 30-inch lens for the Mount Wilson Observatory and the 40-inch lens at the Yerkes Observatory. He died at New York City, June 9, 1897.

CLARK, CHAMP (1850-1921), American political figure, was born in Anderson Co., Ky., Mar. 7, 1850. He early shortened his baptismal names James Beauchamp to Champ. He attended Kentucky University and Bethany College, W.Va., from which latter institution he graduated in 1873. After his

graduation he was for a year president of Marshall College, Huntington, W.Va. In 1875 he completed the year's course at the Cincinnati Law School. After a brief residence in Wichita, Kan., he moved to Missouri. He was Prosecuting Attorney of Pike Co., Mo., 1885-89, and a member of the Missouri Legislature, 1889-92. In 1893, as a Democrat he was elected to Congress, in which, except for the term 1895-97, he served continuously until 1921. He was a witty, forcible speaker, and a prominent figure on the committees on Foreign Affairs and Ways and Means. In 1907 he succeeded to the leadership of the Democratic minority party. He led the fight against the arbitrary control of legislative procedure by Speaker Joseph G. Cannon. Clark was elected Speaker of the House in 1911, to which office he continued to be re-elected until Mar., 1919. In 1912 at the Democratic National Convention which nominated Woodrow Wilson, he was the leading candidate for the presidential nomination until the 14th ballot. (See HOUSE, EDWARD M.) He was the minority leader of the House from 1919 to 1921. He was defeated for re-election in the Republican landslide of 1920. He died in Washington, D.C., Mar. 2, 1921.

CLARK, FRANCIS EDWARD (1851-1927), American clergyman, was born at Aylmer, P.Q., Canada, Sept. 12, 1851. He was educated at Dartmouth College and at Andover Theological Seminary and served as pastor of a Congregational Church in Portland, Me., 1876-83. From 1883 until 1887 he was pastor in South Boston, Mass. In February 1881, in connection with his pastoral work in Portland he founded the Young People's Society of Christian Endeavor. This small organization eventually spread to other denominations and became active throughout the United States and in many parts of the world. After 1887 Dr. Clark, as president of the United Society of Christian Endeavor and of the World's Christian Endeavor Union, and editor of *The Golden Rule*, gave all his time to the Society's work. He wrote a number of books, and traveled extensively. He died at Newton, Mass., May 26, 1927.

CLARK, GEORGE ROGERS (1752-1818), American soldier, was born in Albemarle Co., Va., Nov. 19, 1752. As a youth he moved into the western lands, later the state of Kentucky, where he became a recognized leader of the frontiersmen. With the outbreak of the Revolution, Clark secured authority from Virginia and crossed the Ohio with the objective of driving the British from the Illinois country, at that time part of the Province of Quebec. From 1778 until the end of the war, Clark was almost continuously engaged in action against the British between the Ohio and the Great Lakes and by his conquests enabled the United States to secure this region in the Treaty of Paris, 1783. Clark then retired upon lands granted him by Virginia and though several times he was on the point of leading expeditions against the Spanish forts on the Mississippi, none eventuated. He died near Louisville, Ky., Feb. 13, 1818.

CLARK, GEORGE ROGERS, EXPEDITION OF, 1778-79, in the Revolutionary War, the brilliant march of a small force of militia against the British controlled posts in the lower Northwest. These posts, Kaskaskia and Cahokia, on the Mississippi, and Vincennes on the Wabash River, were settled by French creoles, and garrisoned by British troops whose presence solidified the alliance of the Indians with the British. George Rogers Clark, major of militia, proposed to Gov. Patrick Henry of Virginia the capture of these posts, and under secret instructions enlisted about 150 Virginians with whom he set out from Brownsville, Pa., on May 12, 1778. Augmented by two small companies from the Holston River and Kentucky settlements, the expedition proceeded down the Ohio to the mouth of the Cumberland, and thence overland reached Kaskaskia. The British garrison was taken by surprise; the French inhabitants with fair willingness swore allegiance to the Revolutionary cause. Vincennes, temporarily under Clark's control, was recaptured by a British force under Gen. Henry Hamilton from Detroit. Isolated from intercourse with the American settlements and anticipating the use of Vincennes as a base of British operations against the frontier settlements as soon as the weather permitted, Clark determined to attack Vincennes before the coming of spring. With 130 men Clark marched over the intervening 230 miles of soggy plains and flooded valleys, and by creating an exaggerated conception of his strength persuaded Hamilton to surrender, Feb. 25, 1779. The conquest of the Old Northwest was not complete, since Detroit remained in British possession; but Clark's expedition was of prime significance in the retention of the Ohio valley by the United States. (See PARIS, TREATY OF, 1783.)

CLARK, JOHN BATES (1847-), American economist, was born at Providence, R.I., Jan. 26, 1847. Graduating from Amherst College, he did advanced work in economics and history at Heidelberg and Zurich universities, and in 1877 joined the faculty of Carleton College, Minn., as professor of political economy. After teaching at Smith and Amherst colleges and lecturing at Johns Hopkins University, he became in 1895 professor of political economy at Columbia University. He was editor of the *Political Science Quarterly* in 1895-1911, and director of the Division of Economics and History of the Carnegie Endowment for International Peace during 1911-23. His works on economics include *The Philosophy of Wealth*, *The Problem of Monopoly and Control of Trusts*.

CLARK, WILLIAM (1770-1838), American explorer, was born in Caroline Co., Va., Aug. 1, 1770. He studied surveying and drawing maps, which with his aptitude for hunting, fitted him for exploration work. In 1803 he was asked by Meriwether Lewis to join the expedition which President Jefferson was sending to explore the Louisiana Territory and find a route to the Pacific Ocean. This resulted in the Lewis and Clark expedition which started in May,

1804 from St. Louis, traveled up the Missouri River, crossed the Rocky Mountains, descended the Columbia River to the Pacific Ocean, and returned to St. Louis in Sept., 1806 with maps and diaries of its explorations. Clark served as governor of the Missouri Territory from 1813 until he became superintendent of Indian affairs in 1822. He was successful in making treaties and settling disputes between the Indians and the whites. He died at St. Louis, Sept. 1, 1838.

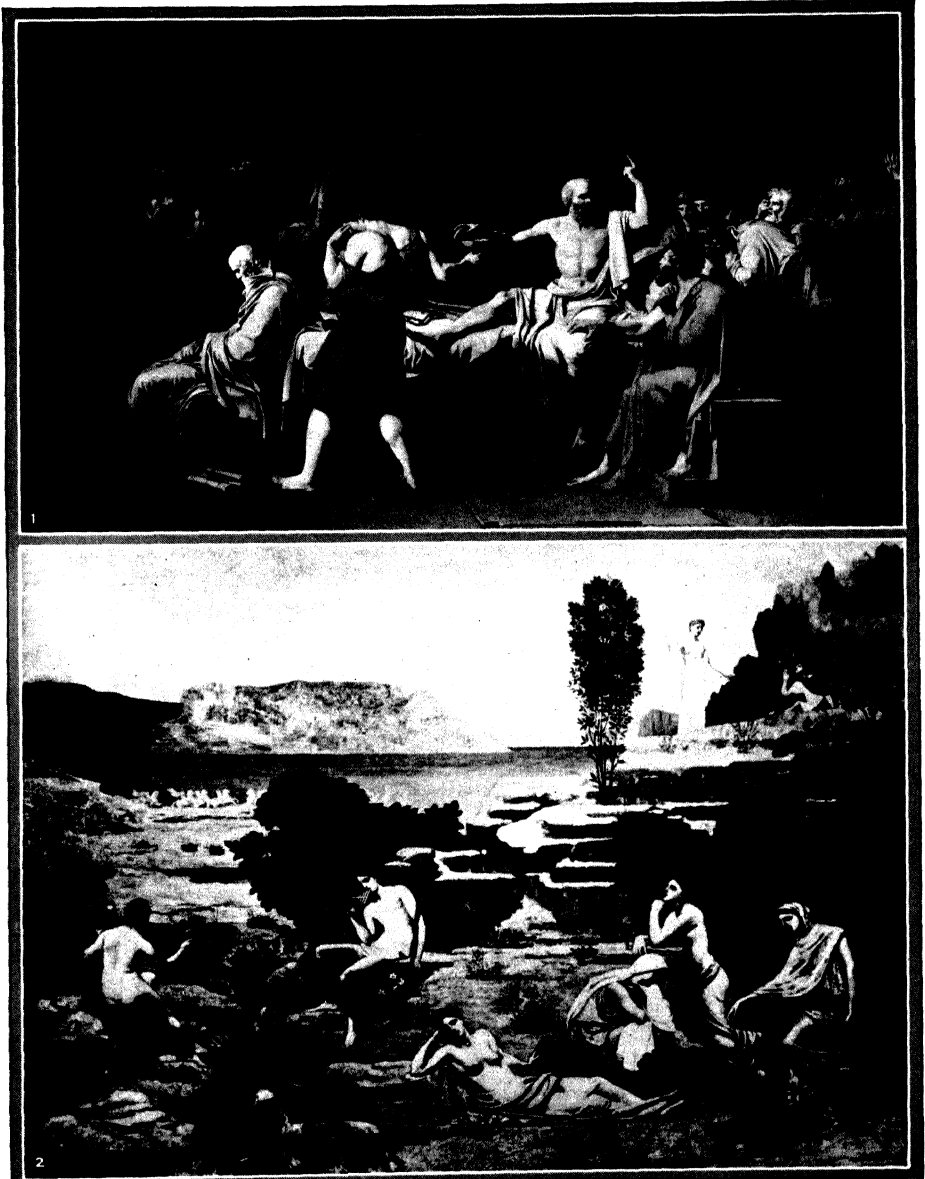
CLARKE, CHARLES COWDEN (1787-1877), English author and scholar, was born at Enfield, Middlesex, Dec. 15, 1787. In 1828 he married Mary Victoria, his partner's sister. The following year Mrs. Clarke began her important *Shakespeare Concordance*, and the Clarkes collaborated in writing the *Shakespeare Key*, and worked on an edition of Shakespeare. Charles Clarke's chief work consisted of his lectures, some of which are collected in the volumes, *Shakespeare's Characters*, chiefly *Those Subordinate and Molière's Characters*. He died at Genoa, Italy, Mar. 13, 1877, and Mrs. Clarke died Jan. 12, 1898.

CLARKE, JAMES FREEMAN (1810-88), American preacher and writer, was born at Hanover, N.H., Apr. 4, 1810. He was graduated from Harvard in 1829, and from Harvard Divinity School in 1833, then for seven years was pastor of a Unitarian church in Louisville, Ky. In 1841 he founded the Church of the Disciples in Boston, with which he remained the rest of his life. He agitated for woman suffrage, temperance and anti-slavery. Of his many published works *Ten Great Religions* is the most widely read. Among others are *Self-Culture* and *The Problem of the Fourth Gospel*. He died at Boston, June 8, 1888.

CLARKE, JOHN HESSIN (1857-), American jurist, was born at Lisbon, Ohio, Sept. 18, 1857. He was graduated in 1877 at Western Reserve University, and beginning in 1878 practised law in several Ohio cities. He was for thirteen years general counsel for the New York Central and the St. Louis railroads. In 1914 he was appointed a United States district judge and in 1916 named an associate justice of the United States Supreme Court. He retired in 1922 to devote himself to the promotion of world peace.

CLARKSBURG, a city of north central West Virginia, and county seat of Harrison Co., on the West Fork of the Monongahela River, about 150 mi. south of Pittsburgh, Pa. It is on the main line of the Baltimore and Ohio Railroad and is intersected by Federal and state highways. The manufacture of various glass products and pottery lead the city's extensive industries, which benefit from rich coal and gas resources of the district. Limestone and clay are also found. In 1929 the value of the factory output was about \$16,000,000; the retail trade amounted to \$17,589,291. Dairying, potato-growing, poultry and stock-raising are interests of Clarksburg's agricultural trading area. At Jackson's Mill, 15 mi. south, a state 4-H Camp, comprising over 500 acres, provides agricultural training for young people. Clarksburg was the birthplace of "Stonewall" Jackson. The first settler was John

CLASSICISM



1. COURTESY METROPOLITAN MUSEUM OF ART; 2. BULLOZ PHOTO

THE CLASSICAL REVIVAL IN FRENCH PAINTING

1. "Death of Socrates," by Jacques Louis David (1748-1825), in the Metropolitan Museum of Art.
2. "Vision of the Antique," by Pierre Cécile Puvis de Chavannes (1824-98), in the Museum of Lyons.

Simpson, about 1765. The settlement, named after Gen. Geo. R. Clark, probably in 1778, was incorporated as a town in 1849. The corporate limits were extended in 1917 and a new charter of 1921 adopted the council-manager system. Pop. 1920, 27,869; 1930, 28,866.

CLARKSDALE, a city of northwestern Mississippi, seat of Coahoma Co. It is situated on a railroad and on two Federal highways, about 75 mi. southwest of Memphis, Tenn. A municipal airport affords additional means of transportation. Clarksdale is surrounded by a fertile agricultural region which produces cotton, corn and lumber. The principal manufacture is cottonseed oil. The retail trade in 1929 amounted to \$8,760,142. The city was founded in 1869 by John Clark. It has the commission form of government. Pop. 1920, 7,552; 1930, 10,043.

CLARKSVILLE, a city in northwest Arkansas, the county seat of Johnson Co. It is situated near the Arkansas River, 101 mi. northwest of Little Rock and is served by bus and truck lines and the Missouri Pacific and Montana railroads. Clarksville is a trade center in a region producing corn, cotton, fruit, coal, natural gas and timber. It is a gateway to the Ozark Mountains and the seat of the College of the Ozarks. Clarksville was founded in 1830. Pop. 1920, 2,127; 1930, 3,031.

CLARKSVILLE, a city in northwestern Tennessee, the county seat of Montgomery Co., on the Cumberland River, 44 mi. northwest of Nashville. Bus lines, river craft and two railroads afford transportation. There is an airport. Clarksville is a trade center for the dark tobacco belt, a region which also raises live stock and strawberries. The chief manufactures are tobacco, snuff and flour. The city is the seat of Austin Peay Normal School, which especially prepares teachers for the rural schools. Woodrow Wilson's father taught at the Southwestern Presbyterian University, of which the Austin Peay School is a successor. Clarksville was founded in 1780 and became a city in 1850. An old house in the city recalls Lafayette's visit. Near by are Dunbar Cave and Idaho Springs. At Dover, in the vicinity, where the battle of Ft. Donaldson was fought, there is a national cemetery. Pop. 1920, 8,110; 1930, 9,242.

CLARK UNIVERSITY, at Atlanta, Ga., founded in 1870 by the Freedman's Aid Society of the Methodist Episcopal Church, is a privately controlled, co-educational institution for Negroes. It maintains elementary, preparatory, collegiate and normal departments. The library contains 6,000 volumes. In 1927-28 there were 462 students and a faculty of 22, headed by Pres. M. S. Davage.

CLARK UNIVERSITY, a coeducational non-sectarian institution at Worcester, Mass. Founded by Jonas Gilman Clark, it was opened in 1889 as a graduate school, setting a unique example in the United States, which did not endure for long. The undergraduate college was not established until 1902, and in accordance with the will of the founder, com-

prises a course limited to three years. The graduate students, who are closely allied with the faculty, lecture occasionally and take charge of classes. The productive funds in 1931 were \$5,330,000. The library contains 137,000 volumes. In 1931-32 there were 337 students and a faculty of 40 headed by Pres. WALLACE W. ATWOOD.

CLASS, in taxonomy, a subdivision of a phylum and is made up of orders. Examples of classes usually recognized in botany are as follows: Among algæ, the *Chlorophyceæ* or green algæ, the *Phæophyceæ* or brown seaweeds, and the *Rhodophyceæ* or red seaweeds; among fungi, the *Phycomycetes* or alga-like fungi, the *Ascomycetes* or sac fungi (yeasts, green mold, mildews), and the *Basidiomycetes* (mushrooms, puff balls, bracket fungi); among Spermatophyta or seed plants, the *Gymnospermæ* (plants with open ovary, pines, spruces, and other conifers and allies) and the *Angiospermæ*, plants with closed ovary (the great bulk of the flowering plants). There are many classes recognized in zoology. Illustrative examples are: in Arthropoda, Crustacea (lobsters, shrimps, crabs), Myriopoda (centipedes), Insecta (insects), Arachnida (spiders); in Chordata (vertebrates and allies), Pisces (fishes), Amphibia (amphibians), Reptilia (reptiles), Aves (birds), Mammalia (mammals). A. S. H.

CLASSICAL EDUCATION. The early American colleges and secondary schools followed the classical traditions of European education. Until 1890 practically every college required for entrance a fundamental knowledge of both Greek and Latin and a further study of both subjects for at least two years in college. To meet these entrance requirements, secondary schools were forced to stress the classics. But with the expansion of the curriculums of both college and secondary schools to include a wider range of subjects, less time was available for the classics and there was a growing opposition to the emphasis which had been laid on them. Greek was finally dropped as an entrance requirement, and there has been a steady and rapid decrease in its study since 1900, until Greek has almost disappeared from the high school curriculum. It is studied by only a relatively small number in college. Though there was a slight decrease in the percentage of students studying Latin after 1900, the big drop came just before the World War, when the interest turned to modern languages. The continued decrease after the War aroused those advocating the study of the classics, and there has been a strong movement to revive the interest in Latin with a resultant increase in the number of those studying the subject.

CLASSICAL SCHOOL OF ECONOMICS. The term classical as applied to economic thinkers ordinarily refers to ADAM SMITH and his immediate successors, T. R. MALTHUS, D. RICARDO, James Mill, H. McCULLOCH and N. W. SENIOR. The common element in their economic philosophy is a devotion to the idea of natural liberty; the main divergence is in contrasting conceptions of the social order to which freedom

from social interference in economic processes might ultimately lead. Adam Smith worked in a practical spirit by exposing the unwisdom of definite instances of state intervention, such as the mercantile system, protection, apprenticeship, corporation, combination and settlement laws. His attitude was grounded on the contemporary belief in a preestablished harmony between selfish impulses and the aims of society. The outcome of *LAISSEZ-FAIRE*, in his view, was bound to be a happier social order. The Ricardians likewise advocated *laissez faire*; but God's world with them was not of necessity a happy world. Humankind might well be caught between the anvil of a niggardly nature and the hammer of animal fecundity. Diminishing returns from land, on the one hand, and increase of numbers, on the other, might well lead in their view to a social situation quite the opposite of Adam Smith's optimistic picture. At the hands of the Ricardians, Smith's hopeful outlook was reversed into pessimistic dogma later characterized as the dismal philosophy.

Among specific doctrines ordinarily associated with the classical school the outstanding ones are the law of diminishing returns, the Malthusian theory of population, the Ricardian law of rent, the wage-fund doctrine, the theory of the inverse and complementary relationship between profits and wages (profits including interest) and the labor theory of value, the last of which was later to be made one of the foundation stones of Marxian socialist theory. The central figure in the classical group was David Ricardo, a banker of philosophic bent whose ideas crystallized and gained currency in the heat of contemporary economic controversies involving banking reform, the CORN LAWS, poor law revision and related issues.

The classical tenets and methodology—which might better be called Ricardian if Adam Smith were left out—have exercised a profound influence on subsequent economic thought. In fact, despite the origin of Ricardian doctrines in conditions peculiarly associated with Napoleonic times, and despite insistence on this limiting fact by many present-day historians and economists, it still remains true that no current treatise on economics fails to revert at least at times to Ricardian viewpoint and method. To be sure, the subject matter of early 19th century political economy is not wealth in its material welfare connotation, but wealth in the sense of commodities and services possessed of exchange value. This type of emphasis tended to lead away from points of interest on which the discussion of socialistic and communistic changes chiefly turns, and to give to economics a business enterprise rather than a social welfare complexion. But the old traditions are yielding and under the impact of current socio-economic experimentation questions which the Ricardians would have relegated to the limbo of things extra-economics are now within the fold of problems germane to the interest of the economist. Thus economics becomes social philosophy, and social philosophy, economics.

R. C. M.

CLASSICISM, a term applied to the late 18th century revival of classic subjects and methods in French painting. It is also referred to as the Davidian School, for this most fundamental breach in French art tradition was brought about by JACQUES LOUIS DAVID (1748-1825), whose rigorous dictatorship throughout the most turbulent period in French history greatly influenced later art. David studied in Rome for 8 years, at a time when the classical reaction started by Winckelmann and the interest in the discoveries of Pompeii and Herculaneum were at their height. He broke away from the frivolous 18th century traditions and inaugurated the classic and grand style with the same uncompromising and inflexible enthusiasm with which he entered into the spirit of the French Revolution, and later turned to Napoleon as a protector against internal and external disorder. Having few or no examples of Greek painting to guide them, David and his students modeled their figures like Greek statues. Color was restrained and sober, being considered a mere accessory. Scenes from mythology and history were nicely balanced and in decorous taste. David was not only a great artist but a genius combining realism and idealism. The severity of his instruction in drawing, anatomy and perspective placed an indelible stamp upon his followers. Among these were Ingres, Géricault, Gros, Navez, Gérard Girodet and Guérin.

CLASSICISM, in literature, a term descriptive of writings which are reasoned and orderly in conception, dispassionately objective in approach and correctly formal in style; as opposed to ROMANTICISM. The term "classic" as applied to literature by the German critic SCHLEGEL (1772-1829), refers to the literature of western Europe, developed in the 17th and carried over into the 18th century, which strove to conform with the rules of classical Latin writing. This imitation of classical Latin authors may be said to have begun in English at the close of the 16th century, establishing a literature of conceits, elaborate and affected in style, and abounding in references to the classics. Of this style, the *Euphuës* of JOHN LYLY is a clear example. By the middle of the 17th century the excessive refinement of EUPHUISM had been transmuted into a more simple and dignified style of writing, which aimed at directness and perfection of style.

Classicism reached its fullest development in France, in prose and in the drama. In the former, Pascal, La Bruyère, Descartes, Fontanelle, Montesquieu and Voltaire are outstanding figures. Their works stand as examples of clarity, sobriety and proportion—the characteristic elements of classicism at its best. The French drama reached its greatest height in the "classical" 17th century, in the plays of Corneille, Racine and Molière.

Throughout the rest of Europe, much of the literature was imitative of the French. In England, Edmund Waller and Dryden introduced the new era with regard to poetry, establishing the HEROIC COUPLET as standard. The 18th century, known as the

Augustan Age, marked the ascendancy of English Classicism, in the poetry and essays of Alexander Pope; the satires of Jonathan Swift (*The Tale of a Tub*, *Gulliver's Travels*, etc.); in the logically developed, highly polished essays of Addison and Steele, published in *The Tatler* and *The Spectator*; and in the various works of Dr. Johnson, who was the guardian spirit of Classicism during his life and for long after his death. See also FRENCH LITERATURE; FRENCH DRAMA; ENGLISH LITERATURE; ENGLISH DRAMA; separate articles on above authors.

BIBLIOGRAPHY.—*The Cambridge History of English Literature*, 1907-17; C. H. C. Wright, *French Classicism*, 1920; H. J. C. Grierson, *Classical and Romantic*, 1923; L. A. Willoughby, *The Classical Age of German Literature*; S. Vines, *The Course of English Classicism*, 1930.

CLASSIFICATION, a grouping of things or ideas. Knowledge of the latter rests upon classification. Things which are alike in some respects may be grouped together and considered as a class. Men, women and children may all be regarded as human beings. The novel, the play, the story and the essay are all forms of literature. The principle selected as a guide to classification should be an important attribute running throughout the group to be classified. Among the most rigorous and elaborate classifications is the biological table of genera and species, together with their specific differentia.

CLASS STRUGGLE, a doctrine of conflict of economic groups, enunciated both in antiquity and in the period of Feudal decadence, but placed in succinct and impelling form by KARL MARX and FRIEDRICH ENGELS who held the class struggle to be "the driving force in social development" with a final outcome of SOCIALISM. Basic is the notion that technical and industrial processes produce classes, graduated in social ranking. "In ancient Rome, we have patricians, knights, plebeians, slaves; in the Middle Ages, feudal lords, vassals, guild-masters, journeymen, apprentices, serfs; in almost all of these classes again, subordinate graduation." In the *Communist Manifesto* of 1848, Marx and Engels say that the coming of CAPITALISM and machine industry simplifies the class structure bringing to the force two hostile camps, the *bourgeoisie* and the proletariat. The former, they hold, is in possession of the means of production and uses its power to take surplus value from the latter under the reign of the competitive system. Inevitably, they believe, the outcome will be the cataclysmic overthrow of capitalism, following upon wealth concentration in the hands of a few and the rising misery of the increasingly-exploited workers.

The doctrine has met with dissent both within and without socialist ranks. Upholders of capitalism urge the natural harmony of the present system or insist that workers are becoming capitalists through the purchase of corporate shares. Sociological opponents insist that racial and nationalistic interests overshadow class cleavage. Fabian socialists and revisionists urge that political democracy, rising living standards and encroaching social control make the conflict increasingly less bitter. The theory now

chiefly sponsored by the communists is that world markets and international capitalism must inevitably lead to world revolution and to the establishment of a dictatorship of the proletariat under their guidance.

C. E. W.

BIBLIOGRAPHY.—Karl Marx, *Capital*, vol. III, 1909; Simkovich, *Marxism vs. Socialism*, 1913; H. Laidler, *Socialism in Thought and Action*, 1920; M. Beer, *A History of British Socialism*, 1921; N. Lenin, *The State and Revolution*, 1926.

CLAUDE, JEAN (1619-87), a celebrated French Protestant clergyman and controversialist, was born at La Sauvetat, near Agen, in 1619. After holding a pastorate at Saint-Affrique, he became professor of theology at Nîmes. Because of his doctrines, Claude was forbidden to preach. At Montauban, where he went in 1662, he again lost his office. He was forced to leave France for Holland upon the revocation of the Edict of Nantes. Here William of Orange became his patron. Claude was one of the greatest champions of the French reformed party, and was the author of *Défense de la réformation*. He died at The Hague, Jan. 13, 1687.

CLAUDEL, PAUL (1868-), French author and diplomat, was born at Villeneuve-sur-Fère, Aug. 6, 1868, and educated at the Lycée Louis-le-Grand, Paris. He filled consular posts in China and became First Secretary to the French Legation at Peking in 1921. After several European appointments and three years at Rio de Janeiro, he was made French Ambassador at Tokyo, and from this position was sent in 1927 as Ambassador to the United States. As poet and dramatist he is recognized as one of the outstanding figures in modern French literature. Among his best known plays are *l'Annonce faite à Marie*, 1912, and his great trilogy, *l'Otage*, 1911, *Le Pain Dur*, 1918, and *Le Père Humilié*, 1919. Many of his plays have been translated into English, and the first-named was produced in the United States. Claudel wrote the libretto of Milhaud's opera, *Christopher Columbus*, first presented in Berlin in May 1930.

CLAUDE LORRAIN or **CLAUDE GELLÉE** (1600-82), French landscape painter, was born at Chamagne in 1600. When he was 13 years old he went to Italy and spent two years in Naples, where he received preliminary art instruction from Godfrey Wals, a Cologne painter. From 1619 to 1625 he worked as an apprentice to Agostino Tassi, who was decorating the palace of the Cardinal di Montalto. In 1627 Claude settled in Rome and stayed there for the rest of his life. He enjoyed the favor of Pope Urban VIII, and rapidly became a celebrated painter. Among his other patrons were the King of Spain and the Elector of Bavaria. Claude was a master in rendering effects of sunlight, and achieved a rich harmony of color which has seldom been surpassed. Among his most important works are *A Seaport at Sunset*, *The Setting Sun*, *The Embarkation of St. Ursula*, and *The Return of Chryseis*. Claude Lorrain died at Rome on Nov. 23, 1682.

CLAUDIANUS, CLAUDIUS (b. 365), Latin poet, was born at Alexandria, Egypt. He was of

Greek parentage, but went to Rome in 395 and adopted the Latin tongue. His best known works are his eulogy of Stilicho in 3 volumes, called *De Laudibus Stilichonis, Raptus Proserpinae*, an epic poem, and *De Bello Gildonico*.

CLAUDIUS (10 B.C.-54 A.D.), Roman emperor from 41-54 A.D., and nephew of Tiberius; full name Tiberius Claudius Drusus Nero Germanicus. On the assassination of CALIGULA he was proclaimed emperor by the praetorian guard. Despite a reputation for timidity and weakmindedness he proved a wise ruler. Governing his provinces liberally, and perhaps influenced by the circumstance that he had himself been born at Lugdunum (modern Lyons) in Gaul, he extended the rights of Roman citizenship and eligibility for admission to the senate to many provincial communities. He built the harbor of Ostia (the port of Rome), and improved Rome's water supply. Under him the conquest of Britain was systematically begun. His historical writings on Rome, Carthage, and Etruria are entirely lost. Claudius' domestic relations were unhappy.

CLAUDIUS, APPIUS, surnamed Caecus, a Roman patrician, was born in the 4th century B.C. Elected censor in 312 B.C., he instigated many political reforms. The Appian Way and the aqueduct, Aqua Appia, to complete which he arbitrarily extended his 18-month term as censor to five years are among his outstanding achievements. Later he served as consul and military leader. He became blind in his old age. Claudius's speech against the peace terms of Pyrrhus was transmitted to writing, and with his other written works, laid the foundations of Latin prose.

CLAUSEWITZ, KARL VON (1780-1831), Prussian general, was born in Burg, near Magdeburg, on June 1, 1780. His first active army service was the Rhine campaigns, 1793-94. In 1809 he became departmental chief in the ministry of war and instructor in the military school. Clausewitz was instrumental in the reorganization of the Prussian army. He rose to be the chief of general staff of Field-marshal Gneisenau. Clausewitz developed the modern strategy applied by Prussia in the wars of 1866 and 1870, and later became the basis of military tactics in the military teaching of many countries. The first three volumes of his collected works contain his masterpiece, *Vom Kriege*. He died of cholera in Breslau, Nov. 18, 1831.

CLAUSIUS, RUDOLF (1822-88), German physicist, was born at Köslin, Jan. 2, 1822. In 1855 he became professor of mathematical physics at Zurich Polytechnic, in 1867 going to the University of Würzburg and in 1869 to Bonn. Clausius contributed much to the study of thermodynamics by his development and expression, in 1850, of the second law, that the exchanges of heat and energy, in a closed system, always increase entropy. He likewise advanced the kinetic theory of gases and developed the theory of detached ions to explain the phenomena of electrolysis. He died at Bonn, Aug. 24, 1888.

CLAUSIUS-CLAPEYRON EQUATION, a relation derived from thermodynamics which expresses the dependence of the saturated vapor pressure of a liquid upon the temperature. It may be expressed in the following form:

$$\frac{dp}{dT} = \frac{\Delta H}{T \Delta V} \quad \frac{d \log_e p}{dT} = \frac{\Delta H}{RT^2}$$

Here p is the pressure, T is the absolute temperature, R is the gas constant, ΔH is the latent heat of vaporization of the liquid per gram-mole, ΔV is the increase in volume per gram-mole which occurs when the liquid changes to vapor, dp/dT and $d \log_e p/dT$ signify in the notation of the differential calculus the change in the vapor pressure and in its logarithm for an infinitely small change in temperature.

The relation requires that, as the temperature is raised, the vapor pressure increases more and more rapidly for each succeeding equal increase in temperature.

L. O. C.

BIBLIOGRAPHY.—E. B. Millard, *Physical Chemistry for Colleges*.

CLAUSSEN, SOPHUS NIELS CHRISTEN (1865-), Danish poet, was born at Helletofte, Sept. 12, 1865. His first book of verse, *Children of Nature*, was written when he was 22. His maturer poems are contained in five volumes. In addition to his poetry, he has written two books of travel, *Antonius in Paris* and *Pilgrimage*; two volumes of essays, *Dandelion Down* and *Spring Discourses*, and several novels and short stories.

CLAVILUX, a keyboard-equipped instrument for the performance of LUMIA, invented by the American artist, Thomas Wilfred. It permits the control of form, motion and color of light, projected on a white screen.

CLAXTON, PHILANDER PRIESTLEY (1862-), American educator, born in Bedford Co., Tenn., Sept. 28, 1862. He studied at the University of Tennessee; at Johns Hopkins and in Germany, and from 1883-93 was superintendent of schools in North Carolina. From 1902-11 Claxton was professor of education at the University of Tennessee and superintendent of the Summer School of the South. He served as United States Commissioner of Education from 1911-21 and from 1923-29 as superintendent of schools at Tulsa, Okla. In 1930 Claxton became president of the Austin Peay Normal School, Clarksville, Tenn.

CLAY, CASSIUS MARCELLUS (1810-1903), American publicist, diplomat, and abolitionist, was born in Madison Co., Ky., Oct. 19, 1810. Throughout his long life he was famous for a quarrelsomeness which often resulted in violence. Graduating from Yale in 1832, he was elected to the Kentucky Legislature in 1835, 1837, and 1840. Despite the large slave-holdings of his father, Clay vigorously opposed slavery, and founded an anti-slavery journal in Lexington, Ky., which after stormy experiences was first moved to Cincinnati and then to Louisville. He joined the new Republican Party in 1856. He was

Minister to Russia from 1861-69 except for a brief interruption, 1862-63, when he served as a major-general of the Union forces in the United States. A disagreement with the policies of Gen. Grant led to his support of the liberal Republicans in 1872. His disapproval of the reconstruction policy led to his support of Tilden in 1876, although he returned to the Republican Party in 1884. He died at Whitehall, Ky., July 12, 1903.

BIBLIOGRAPHY.—His autobiography, *Life of Cassius Marcellus Clay*, 1886.

CLAY, HENRY (1777-1852), American statesman, was born in Hanover Co., Va., Apr. 12, 1777. His family moved to Richmond in 1791 where he worked first in a store and afterwards in the clerk's office of the High Court of Chancery. He also did some copying work for Chancellor George Wythe, who directed the reading which Clay, in addition to his work, undertook to educate himself. He began the study of law in 1796 in the office of Attorney General Robert Brooke and the following year was admitted to the bar. In 1797 he moved to Lexing-



HENRY CLAY'S HOME, "ASHLAND," AT LEXINGTON, KY.

ton, Ky., where he speedily acquired a reputation as a successful criminal lawyer. He served in the Kentucky legislature (1803-06) and in 1806 was sent to the U.S. Senate to fill an unexpired term which ended in 1807. The same year he was once more sent to the Kentucky legislature, where he was elected speaker, continuing in that capacity until 1809 when he was sent to complete another unexpired term in the U.S. Senate. In 1811 he entered the U.S. House of Representatives, which elected him Speaker on the first day of his term. He was recognized as the leader of the "War Hawks" and by appropriate committee appointments and by fervid oratory he aided in precipitating the War of 1812. In 1814 Clay resigned from the House to go to Ghent as one of the commissioners to negotiate the peace treaty with England. He acted as the spokesman of the West at the peace meeting and quarreled sharply with John Quincy Adams who wanted to permit England the free navigation of the Mississippi in exchange for the use of the northeastern fisheries. He was reelected to the House in 1815 and was again elected Speaker. He resigned as Speaker in 1820 and withdrew from the House, Mar. 4, 1821.

Clay was now recognized as one of the leading political figures of the country. Madison and Mon-

roe both offered him the post of Secretary of War which he declined, as well as Madison's tender of the ministry to Russia and Monroe's offer of the ministry to England. Clay already had presidential ambitions which he supported with a comprehensive program which came to be known as "The American System." The core of his system was a protective tariff which would reserve for Americans the benefits of the internal market. Manufacturing districts would thereby have a large market for their goods and the agrarian regions would simultaneously profit by supplying the manufacturing and commercial districts with raw materials and foodstuffs. As incidents of the development of the internal market Clay advocated a national bank, internal improvements in the form of roads and canals, and an adequate military protection of the nation. Since all of these favors could be conferred only by a strong central government, he was intensely nationalistic and unsympathetic to the doctrine of states rights. Living in a district which lay between the North and the South and which was located in the West and yet produced many manufactures, he comprehended the diverse needs of the varied industrial regions of the country, and his rôle as "the great compromiser" was in a way largely an expression of the contradictory requirements of his own Kentucky.

Clay by nature was a lovable man who endeared himself to Americans by his excessive patriotism and his glittering, persuasive oratory, which was usually superficial and often illogical. In debate, he lacked the dialectical qualities of Webster's literary eloquence and the keen analytical qualities of Calhoun's carefully wrought arguments. In the debates on the Missouri Compromise, 1820, his emphasis was on the necessity of perpetuating the Union, the slavery issue being of secondary importance to him. In 1822 the Kentucky legislature nominated him for the 1824 presidency, and as a political manoeuvre he was reelected to Congress in 1823. In 1824 Clay ran fourth in a presidential race in which no candidate received a majority of the electoral votes. In compliance with the Constitution, his name was dropped from the contest in the House. Clay diverted his following to John Quincy Adams who was elected in 1825 and when the latter appointed Clay his Secretary of State, Jackson's followers charged the Kentuckian with a corrupt bargain. Clay left office in 1829 with John Quincy Adams after a tedious four years in which his most conspicuous labor was an effort to associate the United States with the other American nations in the Pan-American Congress of 1826.

In 1830 the Kentucky legislature once more nominated Clay for the presidency and sent him to the U.S. Senate in 1831. The issue of the 1832 campaign was the re-chartering of the United States Bank which Clay advocated. Andrew Jackson defeated him. In 1836 as a Whig, he was reelected to the Senate, where he was recognized as the champion of the protective tariff, and in 1840 he unsuccessfully sought the Whig nomination for the presi-

dency which was awarded to William Henry Harrison. Harrison after his election offered the post of Secretary of State to Clay who refused it, preferring to stay in the Senate to guide the Whig plans for a re-chartering of the bank and a protective tariff. The Whig aims were thwarted by the death of Harrison and the opposition to their measures of John Tyler, his successor. Clay withdrew from the Senate in 1842 and in 1844 was once more a presidential nominee. In a campaign in which Polk, his successful opponent, advocated the annexation of Texas, Clay offended many by his equivocal attitude towards that issue and thereby lost the election. An unsuccessful candidate for the Whig nomination of 1848, he returned to the Senate in 1849 to prevent the threatened disruption of the country following the Mexican War. He was largely responsible for the series of acts known as the Compromise of 1850 which it was hoped would avoid Civil War. He died June 29, 1852. S. McK.

CLAY, a product of rock weathering in which the classification depends more on grain size than on definite physical or chemical properties, but which usually consists of KAOLIN. Clay and SLT comprise material composed of particles ranging from 0.05 to 0.0001 mm. in diameter. Clays fall into two categories, residual and transported. Residual clays are formed from feldspathic rocks, such as GRANITES, by decomposition of the contained silicates, from SHALES by simple disintegration, and from LIMESTONE by solution and removal of the carbonates. Clays thus formed may then be transported by streams and deposited in quiet water. Glaciers and winds also serve as transporting agents. By compaction clays pass into shales.

Pure clay is white and is ordinarily composed of kaolin, a hydrous aluminium silicate. This is fire clay. Various impurities are usually present, such as carbonates, silicates, quartz, iron oxide and organic material. These color the clay yellow, brown, gray, blue, red, green and black.

The uses to which clay is put depend on its degree of plasticity, tensile strength, shrinkage, fusibility, color, specific gravity and chemical properties. The desired object is molded of wet clay and hardened by baking in a special furnace, or kiln. Pottery, brick, tile, porcelain and china are made in this manner. Clay is also used in making pigments, cement, road material, ballast, oilcloth, and as filler in cotton bleacheries and paper manufacturing, and one form, Fuller's earth, is used for bleaching and clarifying oils.

Clay is of such widespread occurrence that it is almost useless to cite particular localities. England and France and, in the United States, Ohio, Pennsylvania, New Jersey and Illinois are important producers. See also FULLER'S EARTH; ADOBE; PETROLOGY; OCHER; ARGILLACEOUS; WEATHERING; DEPOSITS; MARL; SEDIMENTATION.

CLAY PRODUCTS. Clay is prepared for manufacture by at least one of three processes. It is pulverized and tempered with water to a plastic state;

it is stirred with an excess of water to produce a creamy fluid used as a fluid in the casting process or stiffened so that a plastic condition supervenes; or it is pulverized and slightly dampened, so that it will become dense under pressure. The first method is used chiefly for structural wares, BRICK, roofing TILE, pipes and conduits and TERRA COTTA. The second is used in the pottery industry, the third for wall and floor tile and sometimes for brick.

In primitive times brick was made by hand. An oblong frame, like a box without top or bottom, was placed on a level slab, of metal or stone, and into it the clay was forcibly thrown by hand. When the frame was full, the top was leveled and the frame lifted off, leaving the brick lying on the slab. In this process the clay must be mixed in a very soft condition in order to fill the corners of the frame. The term "soft mud" has, therefore, been used to describe the method. In modern times the clay is mixed by machine power in a horizontal trough, and a plunger squeezes it into a gang mold of six members. Brick for filling and backing is generally made thus. Brick for facing must have a better finished surface, and is commonly made from a much stiffer mixture propelled by force from a rectangular horizontal die. The bricks are then divided by taut wires properly spaced. By the third process the moistened clay is fed to a steel rectangular die, and a powerful plunger compresses it into a solid mass. The same method is also used for wall and floor tile.

Pottery is made both from plastic clay and from the fluid clay known as slip. Molds made of plaster-of-Paris are generally used. In the former case for making circular pieces the mold is fitted to the head of a vertical lathe similar to a potter's wheel. The clay is pressed on or into the mold, and the workman completes the shaping by the use of a steel tool. The piece is dried on the mold, and then smoothed. The casting process involves the use of slip; and molds of a more complicated nature are used. For example, the mold of a jug is in three parts, the handle included. The mold is firmly bound, and the slip poured in. A wall of solid clay accumulates on the inner surface of the mold, and, when the wall is thick enough, the remaining slip is poured back into the original container. After a short time the mold is unbound and opened, and the piece of pottery is removed. It is then dried, smoothed and fired. C. F. B.

CLAYTON, HENRY DE LAMAR (1857-1929), American jurist and legislator, was born in Barbour Co., Ala., Feb. 10, 1857. He received his LL.B. degree from the University of Alabama in 1878 and, after practicing law in his native state, was a member of the Alabama General Assembly. Clayton became district attorney of the Middle District in 1893 and four years later was elected to Congress, where he served until 1914. He drafted the CLAYTON ACT of 1914 which directed legislation against trusts. Clayton resigned from Congress to become judge in the Middle and Northern districts of Alabama. Throughout his

life he held important posts in the Democratic Party. He died Dec. 21, 1929.

CLAYTON, JOHN MIDDLETON (1796-1856), American statesman, was born at Dagsborough, Del., July 24, 1796. Graduating from Yale in 1815, he studied law for several years, including two at the Litchfield Law School, and was admitted to the Delaware bar in 1819, beginning practice at Dover, Del. In 1828, he was elected as a Whig to the U.S. Senate, and reelected in 1834, serving from 1829 until 1836, when he resigned to become chief justice of Delaware. In the Senate he consistently supported the Whig policies of a protective tariff and friendliness to the U.S. Bank, although he supported Jackson in the nullification episode. He resigned from the bench in 1840 and acquired a reputation for scientific farming. In 1845 he was again elected to the Senate where he supported the Mexican War, although he had desired peace before the declaration of war. He entered the cabinet as President Zachary Taylor's Secretary of State in 1849 where his most important work was the negotiation of the Clayton-Bulwer Treaty (1850) with England which by the mutual pledge of the two nations to maintain the neutrality of any canal across Central America, and not to colonize in that region possibly prevented war. Clayton retired to private life July 22, 1850, after the death of President Taylor. He reentered the Senate in 1852 where he defended his treaty from vigorous attack. He died at Dover, Del., Nov. 9, 1856.

CLAYTON, a city in eastern Missouri, the county seat of St. Louis Co., situated four mi. west of St. Louis. It is served by the Chicago, Rock Island and Pacific Railroad. Truck crops, flowers and fruit are grown in the vicinity. The city has various manufactures, including metal products, railroad equipment and furniture. It is the seat of Washington University, Eden Theological College, Fort Bonne College, Concordia Seminary, Christian Brothers College and Chaminade College. Clayton was founded in 1876; incorporated in 1913. Pop. 1920, 3,028; 1930, 9,613.

CLAYTON ACT OF 1914, THE, reflects in large part the preelection promise of Woodrow Wilson to recommend legislative prohibition of specific business methods used by Trusts in securing and maintaining a dominating, if not monopolistic, position in certain fields. Four sections of the act prohibit, with certain qualifications, price discriminations, exclusive selling or leasing contracts of patented or unpatented articles, intercorporate shareholding, and interlocking directorates, when the effect "may be to substantially lessen competition or tend to create a monopoly" or when the elimination of competition by agreement between corporations having a director or directors in common would constitute a violation of "any of the antitrust laws." To these major provisions were added, during Congressional discussions, other sections declaring that the "labor of a human being is not a commodity or article of commerce"; that the existence and opera-

tion of labor, agricultural or horticultural organizations should not be held or construed as violative of the antitrust acts; and that decrees and judgments in government antitrust suits (except consent decrees) were to be accepted as *prima facie* evidence in private suits for damages resulting from violation of antitrust acts. The FEDERAL TRADE COMMISSION was empowered to enforce the antitrust sections of the Clayton law.

In addition to the clarification of antitrust policy embodied in the foregoing prohibitions, the Clayton Act has put a stop to undesirable practices in some of the major industries. In spite of a few outstanding successes, however, the Clayton Act has not proved as effective a check upon combinations as was hoped by its authors. There are a number of reasons for this. In the first place there is considerable ground for the frequently made contention that parts of the law were poorly drafted. In certain cases, for example, the SUPREME COURT has interpreted Section VII, relating to intercorporate stockholdings, to permit a corporation to retain control of another secured by purchases of its stock (tendency toward monopoly being established), provided that the first corporation took over the business and assets of the second before the Trade Commission took action under Section VII. More important is the fact that business men have simply turned to other methods. Consequently, the importance of the Clayton Act has become definitely subordinate to that of the Trade Commission Act. See also FEDERAL TRADE COMMISSION; SHERMAN ANTI-TRUST ACT. C. A. G.

CLAYTON-BULWER TREATY, 1850, an agreement between Great Britain and the United States, for facilitating the construction of a ship canal between the Atlantic and Pacific oceans. Sir Henry Lytton Bulwer, British Minister in Washington, and Secretary of State John M. Clayton, after a year of negotiations, drafted a program of cooperation. Each country promised to aid in the construction of a canal through Nicaragua, guaranteed its neutrality, and explicitly renounced any claim to dominion over any part of Central America. The principle of neutrality was to be extended to any canal or railway constructed across Panama. Within five years after the ratification of the treaty, a railway across Panama was completed. But ill-feeling because of the revelation that Great Britain did not construe the renunciation of dominion as affecting her previously acquired territory in Central America prevented the immediate construction of the canal.

CLEARANCE PAPERS are papers giving permission from the custom house of a United States port for a vessel to sail. The issuing of the papers or "clearing" signifies that all port dues and formalities have been taken care of.

CLEARFIELD, a borough in western Pennsylvania, the county seat of Clearfield Co., situated on the west branch of the Susquehanna River, 35 mi. north of Altoona; it is served by three railroads. Clearfield is in a rich coal and clay region, and has

a sewer pipe factory, brick plants, tanneries, an underwear factory, a silk plush mill, a printing plant and various other industrial establishments. Also located here is an extensive state forest nursery. The borough is situated on the edge of Allegheny Plateau. Pop. 1920, 8,529; 1930, 9,221.

CLEAR GRITS, in Canadian political history from about 1845-67, a radical faction powerful to Upper Canada. Its leader, after 1850, was GEORGE BROWN, whose Toronto *Globe* was especially influential among the Scotch element. The Clear Grits, meaning all sand and no dirt, clear grit all the way through, advocated popular election of all government officials by secret ballot and unrestricted male suffrage, biennial parliaments, free trade, direct taxation and the eradication of special privileges. The influence of the Roman Catholic Church was particularly assailed. The secularization of the clergy reserves, and representation by population, were demanded.

CLEARING HOUSE. Clearing is an offsetting of claims by which their actual payment in cash is avoided, and only the remaining balances required to be paid. A clearing house is an institution established to effect this purpose in connection with check payments, although it is utilized also for stocks and bonds. Another type of clearing house, outside the scope of this article, is a central registry office for CREDIT information.

The first clearing house for checks was founded in Edinburgh in 1760; one was established in London in 1773, in New York in 1853, in Paris in 1872, and in Berlin in 1883. Most large cities now have clearing houses.

The technique is not complicated. Each bank, instead of sending to each of the other banks the checks drawn upon it and deposited with the sending bank, sends all checks to the clearing house by at least two messengers—one to distribute the items for collection among the messengers of the other banks, and the other to act as receiving clerk for the items brought by other messengers. It requires only a few minutes for the clerks to total their sheets and report the balance—the difference between the bundles which they have distributed and those which they have received. In the United States this balance is settled usually on the books of the Federal Reserve banks. At the New York Clearing House there are three clearings daily.

Before the organization of the Federal Reserve System, the clearing houses of the United States, and especially that of New York, exercised other important functions, since they were the only institutions through which cooperative action of the banks could be secured. They usually set certain standards for membership, and reserves to be held. They established common practices as to commissions and collection charges, had their own examiners, and at times of panic they often issued clearing house loan certificates to assist their members in meeting daily balances at the clearing house.

Since the banks of the FEDERAL RESERVE SYSTEM undertook the task of clearing intercity items, the clearing houses have lost much of their importance, and they function merely as a clearing agency for intricacy checks; though occasionally they still serve as a medium for common action in such matters as setting the rate of interest on time deposits. The clearing of checks between cities of each Federal Reserve district is handled by the Federal Reserve bank of that district, and between districts the balances are settled by daily telegraphic transfers in the gold settlement fund at Washington, where each of the Reserve banks is required to keep an account of at least \$1,000,000 for that purpose.

Clearing systems are also well developed abroad, especially in Austria and Germany. Countries like England, Scotland and Canada, which possess widespread branch banking systems, do not require such elaborate clearing organizations as those with independent banks. See also CALL LOAN. B. H. B.

CLEAR LAKE, a town in Cerro Gordo Co., northern Iowa, situated on Clear Lake, about 10 mi. west of Mason City. It is served by the Chicago, Milwaukee, St. Paul and Pacific Railroad. Clear Lake is a popular summer resort, with good fishing and boating; it is also a shipping point for grain and live stock. Pop. 1920, 2,804; 1930, 3,066.

CLEAR LAKE PARK, a state park in Cerro Gordo Co., north central Iowa, not far from Mason City. The park, established in 1923, has an area of 20 acres and contains a 940-ft. lake frontage. Just west of the park proper is an extensive marsh with a fine bird and plant refuge.

CLEARSTORY. See CLERESTORY.

CLEARWATER, a city on the western coast of Florida, the county seat of Pinellas Co., on Clearwater Bay. Two railroads serve the city. Springtime Airport is near by. The beautiful Pinellas Co. is splendid truck farming country, citrus fruits being especially abundant. The city has large fisheries, fruit canneries and packing houses. Pop. 1920, 2,427; 1930, 7,607.

CLEAVAGE, the property shown by some crystalline minerals of splitting along certain planes parallel to possible CRYSTAL faces. The resultant cleavage surfaces are relatively smooth and brilliant. They may show different quality in various minerals, and even in the same mineral in different directions. Cleavages are named, according to their orientation in the crystal, as prismatic, basal, cubic and with respect to their perfection, as perfect, imperfect, interrupted. Common mica has a perfect basal cleavage. This property is a result of the arrangement of the molecules in definite patterns, or space lattices, characteristic of crystalline material. Comparatively poor cohesion exists across those planes which can be passed between widely separated sets of molecules, and cleavage may result along such planes.

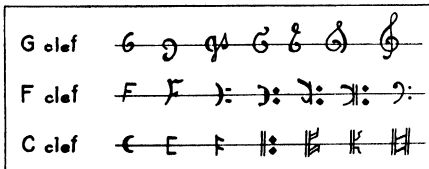
The term cleavage is also applied to an unrelated phenomenon in certain rocks which show great ease in splitting. This may be due to the original bedding

planes, as in shale, or to the fact of pressure and heat producing a parallel arrangement of the constituent minerals, as in slate. *See also* CRYSTALLOGRAPHY; MINERALOGY.

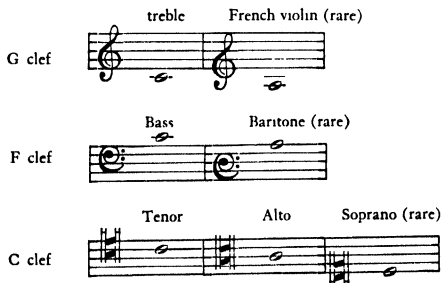
CLEBURNE, a city in north central Texas, the seat of Johnson Co., situated 25 mi. south of Ft. Worth. The Chicago, Rock Island and Pacific, and the Atchison, Topeka and Santa Fé railroads provide transportation. The city is surrounded by stock-raising and cotton-growing country, and has cotton gins and compresses, cotton-seed oil mills, railroad shops and various factories. In 1929 the retail trade amounted to \$6,380,146. The city was named after Gen. Patrick Ronayne Cleburne of the Confederate Army. It was founded in 1867 and incorporated in 1871. Pop. 1920, 12,820; 1930, 11,539.

CLEF, in musical NOTATION, a symbol centered on one of the lines of the musical staff in order to determine its pitch and thus the PITCH of all the other lines and spaces. There are two clefs in common use to-day, the treble or G clef, and the bass or F clef, ♭. These indicate respectively the G above and the F below middle C. In addition to these the C clef, ♮, is much used in orchestral music, and is called the tenor clef, the alto clef, or the soprano clef (the latter infrequently), according to the line upon which it is placed. The purpose of different clefs is the simple one of making a five-line staff serve the needs of highly varied pitches.

The use of clefs goes back to the 11th century, and the evolution of their formation may be traced in the progressive modifications of the corresponding Gothic letters from which they sprang. Various stages in the development of the three clefs mentioned are illustrated by the following examples:



For ready comparison of these different clefs, middle C is written in all the following examples:



CLEFT PALATE AND HARELIP, congenital fissure of the roof of mouth and lip. Possibly two thousand babies are born each year with an open vertical cleft through the lip or palate on one or both sides through which the outer skin and mucous linings are continuous. The cleft may be partial, or complete. Rarely it involves the cheek to the inner corner of the eye.

The condition is hereditary in about a third of all cases. Such children are not mentally deficient, but a consciousness of the deformity or inability to fully profit by school work often seriously hampers their progress. The open palate predisposes to recurrent middle ear infections with consequent partial deafness.

The primary abnormality is simply a failure of closure of a normal cleft at the proper time, but most of the deformity consists of distortion and displacement of the surrounding bone and soft tissues, due to tongue pressure and muscle pull. Surgical operation, for the correction of these defects, attempts, by undercutting, to allow overcorrection of the distorted tissues and then, after freshening the cleft borders, to unite them by suturing. In the lip and nose there is usually enough tissue to make an acceptable restoration in almost all cases, but it is one of the most difficult operations in surgery, with the result that most of the afflicted ones go through life with a not pleasing appearance.

Early repair of the lip and floor of the nose checks further progress of the deformity. The resulting pressure quickly approximates the palate bones and brings the gums, jaws, and teeth into the best attainable position and relationship. Attempts to approximate forcibly the cleft borders by fracture of the bones or by the pressure of wires passed through the bone are unnecessary and may be followed by frightful bone deformities, uncorrectable malrelation, or early loss of the teeth. Where the lip is intact or successfully closed, a palate previously not operated on can usually be closed by flaps raised from the soft tissues covering the palate bone, best done at one or two years. Closure of the palate cleft by a dental plate is, on the average, less apt to be satisfactory, and it is difficult to retain such an appliance after the teeth are lost.

"Cleft palate speech" is due partly to shortness of the palate and chiefly to lack of normal muscle development. The greatest help will come from a successful surgical closure, which can be supplemented by speech training. The lip can be advantageously closed at any time the child is in good condition, the first two days of life offering distinct advantages; but good repair can be made in the adult. Not-pleasing lips can always be improved, and where the palate tissue has been completely lost following previous operations the cleft can still be closed by extra palatine flaps turned from the forehead, neck, arm, or abdomen. *See also* CHILDREN, DISEASES OF: Prenatal Diseases.

V. P. B.

CLEISTHENES, an Athenian statesman, who remodeled the Athenian Constitution, c. 510-500 B.C.

Previously the people had been divided into four tribes in which local and traditional interests often outweighed the desire to serve a common purpose. Abolishing these tribes, Cleisthenes created ten new tribes, each one of them subdivided into three demes. The three demes of each tribe were situated in different parts of Attica and were composed of citizens of widely divergent interests. Furthermore the members of the new tribes having no ancient and separate traditions tended to keep the common welfare of Athens more steadily in view. Cleisthenes also reorganized the *BOULE*, or council, of Athens, enlarging it from four to five hundred, each of the new tribes being represented by fifty members. Cleisthenes devised the institution of ostracism, later frequently abused, whereby the temporary banishment of a party leader by popular vote might resolve a political deadlock.

CLEISTOGAMY, the normal production of flowers which never open and are self-pollinated. Cleistogamous flowers are usually small, inconspicuously located and sometimes even subterranean. They are produced by a variety of different plants, the violet and pansy for example, usually in addition to larger cross-pollinated flowers, and often yield more seed than the larger ones.

CLEMATIS, a large genus of plants of the crow-foot family comprising about 150 species, found chiefly in temperate regions, some 20 of which grow wild in the United States, with numerous forms and hybrids in cultivation. They are mostly woody vines bearing large, handsome, white, blue, purple or scarlet flowers, and conspicuous seeds usually provided



CLEMATIS

with long feathery awns. Among the native American species are the virgin's bower (*C. virginiana*), growing from Nova Scotia to Manitoba and southward to Georgia, the western virgin's bower (*C. ligusticifolia*) growing from Missouri westward, the scarlet clematis (*C. texensis*), found in Texas, and the pipe-stem clematis (*C. lasiantha*), found in Cali-

fornia, all of which are more or less cultivated. Old World species popular for ornament are *C. viticella* and *C. vitalba*, of Europe; *C. florida*, *C. paniculata* and *C. patens*, of Japan; and *C. lanuginosa*, with blue-gray flowers 6 in. across, of China.

CLEMENCEAU, GEORGES (1841-1929), French statesman and journalist, born on Sept. 28, 1841, at Movilleron-en-Pareds in the Vendee district in France. He came of a middle-class family that for generations had followed the profession of medicine. From his father, Dr. Benjamin Clemenceau, he early imbibed the materialism and anti-religious tendencies that characterized his whole life. The unjust arrest and harsh treatment of his father by the imperial authorities confirmed him as a youth in his hatred of Napoleon III and his government.

In 1860, Clemenceau, deciding to become a doctor, went to Paris to pursue his medical studies. His student days were marked more by republican plots and associations than by the carefree Bohemianism of the time. In 1862, he helped to found a short-lived liberal newspaper, and spent two months in jail as a result of his share in an anti-empire demonstration. Three years later, he took his medical degree, and became a full-fledged doctor, although he was not destined to practice much, save for some electioneering-clinical work. In the same year (1865), after a short visit in England, he went to the United States to see republicanism at work. In America, he helped to support himself by teaching riding and French at a school for girls in Stamford, Conn. While in New York in 1869 he married Mary Plummer of Springfield, Mass., by whom he had three children; he was divorced from her after 23 years of marriage. Returning to Paris, Clemenceau took part in the overthrow of the Empire (1870) and was first appointed, then elected, mayor of the 18th *arrondissement* of Paris (the Montmartre district). Elected the next year to the National Assembly, he voted against the peace preliminaries. By trying to prevent the execution of two generals by their mutinous soldiers, he lost his popularity with the voters of the Montmartre, and, by attempting to act as a mediator between the National Assembly at Versailles and the *communards*, he came to be distrusted by both parties.

Beaten in municipal elections early in 1871, he resigned his positions as mayor and as member of the National Assembly. But before the year was out, he was elected to the Municipal Council of Paris from the Clignancourt district. For five years he served in that body, rising, in 1875, to be its president. In 1876, he was elected to the Chamber of Deputies from his old Montmartre district. During the next 20 years, he won fame in the Chamber as a sturdy, republican anti-Catholic of the Gambetta school, as a caustic critic whose irony had more bite than the direct attacks of others, as the man who helped to effect the resignation of the Ferry ministry (1885), the resignation of President Grevy (1887) and the election of Carnot (1887).

In 1880, Clemenceau had founded a newspaper, *La*

Justice, which he used to reinforce his political efforts, while to other papers, reviews and magazines he contributed innumerable articles, usually of a political nature. When the Panama scandals burst upon France, Clemenceau was involved only in a slight degree, but some of his political enemies sought to prove that he had sold his paper to be used for German propaganda, since one of his backers was a mysterious German-American, Cornelius Herz. He refuted these charges in a bitter campaign but was defeated for the Chamber in 1893. When the Dreyfus case came to the fore (1897-98), Clemenceau threw his influence and that of his papers, *La Justice* till 1900, *Le Bloc* 1900-02, *L'Aurore* after 1903, to the side of Zola and the accused captain. In 1902, he was elected to the Senate and sat with the Radical Socialists. In 1906, Clemenceau abandoned his rôle of critic for the first time and took office as Minister of the Interior in the Sarrien cabinet. In June, he broke with Jean Jaures and the socialists on the question of using troops against strikers. In October, the Sarrien cabinet fell and Clemenceau was summoned to form a ministry. He was premier for three years. During that time he strengthened the Anglo-French entente, but he was troubled by Germany in diplomacy and the attacks of the Socialists in home affairs, although it was he who began the nationalization of the French railroads. His ministry fell after a venomous attack in the Chamber, by Delcassé, on the question of the state of the navy.

In 1913, Clemenceau founded a new paper, *L'Homme Libre* (*The Freeman*), in which he urged preparedness and supported the three-year-compulsory-military-service act, as a measure necessary against Germany, although he fundamentally disapproved of such militarism. When the World War broke out in 1914, he filled his journal with pleas for the energetic prosecution of the war, for more men, guns and ammunition and for better hospital service. So caustic were his criticisms of the government that the paper was censored and finally suspended (Sept., 1914) only to reappear immediately as *L'Homme Enchaîné* (*The Chained Man*). Through his paper, Clemenceau was the voice of patriotism urging war to end against Germany. When, in 1917, defeatism grew among the French, troops mutinied and the populace was discouraged, Clemenceau, aged 76, was summoned by Poincaré to be premier. With "The war and nothing but the war" as his motto, Clemenceau set himself to lead France to victory. He centered all his attention on winning the war and was instrumental in putting Foch in supreme command of the Allied armies.

After the armistice and victory had come, Clemenceau was a leading figure in the peace settlement. As one of the "big four" of the Versailles conference, he represented the views of France on the need for her future security. Though he did not take the extreme position held by Foch and others, he won many concessions which were written into the treaty.

After the signing of the treaty, Clemenceau hoped

to be elected president, but the Chamber and the Senate, annoyed by the fact that they had been ignored in the peace negotiations, chose Deschanel. In 1920, the Clemenceau ministry was voted out and Millerand came in as premier. Clemenceau retired to private life, to the writing of his memoirs and his philosophy. In 1922 he toured the United States urging Franco-American harmony. The "Tiger" who had led France to victory died, Nov. 24, 1929, and was buried without religious or public ceremonies, as he had wished.

C. W. C.

BIBLIOGRAPHY.—J. Martet, *Georges Clemenceau*, 1930; G. J. Adam, *The Tiger*; *Georges Clemenceau*, 1930; G. Clemenceau, *Grandeur and Misery of Victory*, 1930.

CLEMENS, SAMUEL LANGHORNE. *See* MARK TWAIN.

CLEMENT, the name of 14 Popes of Rome. Clement I (?-c.101). *See* separate article on this Pope. Clement II (Pope from 1046-47) tried to prevent abuses in the Church. Clement III (1187-91) organized the Third Crusade against the Saracens; Clement IV (1265-68), valued councillor of Louis IX of France (St. Louis), approved Charles of Anjou's possession of the Kingdom of Sicily and fought against the practice of giving offices to relatives. Clement V (1305-13) transferred the Papal residence from Rome to Avignon, France, thus beginning the "Babylonian Captivity" lasting 70 years. He abolished the order of Knights Templar. Clement VI (1342-52) was Pope at Avignon and purchased the city from Joanna of Naples. He established the Jubilee which is celebrated every 50 years. Clement VII (1523-25) was imprisoned in the Castle of St. Angelo when Charles V sacked Rome. The separation of England from the Holy See occurred when Clement refused a divorce to Henry VIII. Clement VIII (1592-1605) edited the *Vulgate* and re-edited the *Index*. During his pontificate Henry IV of France renounced Protestantism and Ferrara became one of the Papal States. Clement IX (1667-69) effected a compromise between the Jesuits and Jansenists in France and established peace between France and Spain. Clement X (1670-76) canonized Rose of Lima, the first American saint. Clement XI (1700-21) condemned Jansenism in two bulls, *Vineam Domini* and *Unigenitus*. He became embroiled in the WAR OF THE SPANISH SUCCESSION and was forced to acknowledge the Archduke Charles as King of Spain. Clement was active in sending forth missionaries. He established the Church in the Philippine Islands. Clement XII (1730-40) erected many handsome buildings in Rome and improved public works throughout his states. He condemned the French Jansenists, and issued a decree against Freemasonry. Clement XIII (1758-69) defended the Jesuits against the Portuguese Marquis de Pombal and the Bourbons. Avignon was taken from him by the French. The authority of the Popes was considerably reduced during Clement's pontificate. Clement XIV (1769-74). *See* separate article on this Pope.

CLEMENT I, ST. (?-c. 101), "first of the Apostolic fathers" and bishop or Pope of Rome, 90 A.D., was,

according to tradition, the third successor of St. Peter. Origen, Eusebius and others believe he was the Clement mentioned by St. Paul in Philippians 4:3. Several manuscripts have been attributed to him, but with the possible exception of his Epistle to the Corinthians, much esteemed by the early church, most are spurious. Little is known of his personal history, and it is believed that he died naturally about 101.

CLEMENT XIV (1705-74), Pope from 1769-74, was born at Sant' Arcangelo, Italy, Oct. 31, 1705. He was made Cardinal under Clement XIII in 1759, and elected Pope in 1769, at a period when the Papacy was at odds with the ruling monarchs. For the welfare of the Church he reluctantly obeyed the Powers (Portugal, France, Spain and Naples) and signed the *Dominus ac Redemptor*, July 21, 1773, abolishing the Society of the Jesuits. Clement XIV died Sept. 22, 1774, and his tomb by Canova is in St. Peter's at Rome.

CLÉMENTEL, ÉTIENNE (1862-), French economist and member of the Gambetta Nationalist group, was born at Clermont-Ferrand, Mar. 29, 1862. He became member of the Chamber of Deputies in 1900 and has occupied several positions in the French cabinet, being Minister for the Colonies (1905-06), Minister of Finance (1914 and 1924-25), Minister of Commerce (1916-20). He was elected a senator in 1920, and was the first president of the International Chamber of Commerce.

CLEMENTINE LITERATURE, refers particularly to the *Epistle to the Corinthians*, "the one genuine writing" of Clemens Romanus (1st century A.D.), although the expression is sometimes made to include all the writings attributed to him by tradition. He was the third bishop or pope of Rome, and is known as Clement I, but of his personal history little is known. The Epistle was much esteemed by the early Church, and its style is simple, earnest and dignified. It contains exhortations to patience under persecution and preaches the necessity for charity, citing the example of the patriarchs, of St. Paul and Christ. The famous reference to the phoenix as a symbol of immortality appears in the Epistle. It disappeared from the Western Church about the 5th century, but was rediscovered in the *Codex Alexandrinus*, which Cyrillus Lucaris gave to Charles I, and was published by Patrick Young at Oxford in 1633.

CLEMENTS, FREDERIC EDWARD (1874-), American ecologist, was born at Lincoln, Neb., Sept. 16, 1874. He received his training in botany at the University of Nebraska, completing his studies in 1898, teaching there from 1894 to 1906, and becoming professor of plant physiology in the latter year. From 1907 to 1917 he was professor of botany and head of the botanical department of the University of Minnesota. Then he became associate in charge of ecologic research at the Carnegie Institute, Washington, D.C. Clements in association with Roscoe Pound was one of the founders of modern ecological practice in their survey of the flora of Nebraska,

The Phytogeography of Nebraska, 1899. Clements' other writings include *Herbaria Formationum Coloradensis*, 1902; *Development and Structure of Vegetation*, 1904; *Research Methods in Ecology*, 1905; *Plant Physiology and Ecology*, 1907; *Cryptogamiae Formationum Coloradensis*, 1908; *Genera of Fungi*, 1909; *Plant Succession*, 1916; *Plant Indicators*, 1920; *Aeration and Air-Content*, 1912, and several scientific works in collaboration with other scientists.

CLEON (died 422 B.C.), Athenian party leader and soldier. He opposed the policies of Pericles in the opening years of the PELOPONNESIAN WAR. After Pericles' death, 429 B.C., Cleon spurred on the Athenians to a more venturesome prosecution of the war. In 425 B.C., he captured a Spartan force at Sphacteria, near Pylos, on the southwestern coast of the Peloponnese. His army was defeated by the Spartan Brasidas at Amphipolis, and he himself was slain, 422 B.C.

CLEOPATRA (69-30 B.C.), Egyptian queen. For a short time she ruled jointly with her brother Ptolemy Dionysus, whom she married in accordance with Egyptian practice. Driven from Egypt by her brother, she persuaded JULIUS CAESAR, to whom she subsequently bore a son, and who was then in the east following his victory over Pompey at the BATTLE OF PHARSALUS, 48 B.C., to secure her throne for her by force of arms. In this successful struggle her brother was slain. Later exerting over MARK ANTONY, whose mistress she became, an influence that endangered the unity of the Roman Empire, the Roman senate at Octavian's instigation declared war upon her. Following the defeat of her fleet in the BATTLE OF ACTIUM, 31 B.C., she fled to Egypt, where she committed suicide. Her intrigues with Caesar and Antony seem to have been less the product of her personal desire than of political considerations, her life purpose being to maintain a strong and independent position for Egypt. With her death the Ptolemaic dynasty ended, and Egypt passed into the possession of Rome.

CLEOPATRA'S NEEDLES, two obelisks of pinkish red Syene granite originally set up by Thothmes III at Heliopolis about 1500 B.C. They were transferred to Alexandria late in the first century B.C. and remained there, popularly known as Cleopatra's Needles, until nearly the end of the 19th century. In 1878 one was brought to London, after an adventurous voyage, and was erected on the Thames Embankment. It is 68½ ft. high and weighs 186 tons. The other, presented by the Khedive of Egypt to the United States, now stands in Central Park, New York City, having been brought over in 1880 and erected in 1881 by Commander H. H. Gorringe, through the generosity of W. H. Vanderbilt. Both obelisks are inscribed with hieroglyphs in honor of Thothmes and Rameses II. The "needle" in New York City is about a foot the taller of the two.

CLERESTORY or **CLEARSTORY**, the wall of the high portion of an enclosed space, where part of a room is higher than the rest, projecting

above the roofs of the lower portions, and so allowing windows which give direct daylight illumination to the high portion. Clerestory lighting is lighting by means of windows in a clerestory wall. The clerestory first appears in the great columnar halls, or



CLERESTORY OF THE PENNSYLVANIA RAILWAY TERMINAL, NEW YORK CITY

hypostyle halls, of Egyptian temples, where the central portion is higher than the sides. The windows are made of pierced stone slabs. The best example is in the great temple at Karnak, built by Seti I and Rameses II. (See EGYPTIAN ARCHITECTURE.) Clerestory lighting was also used extensively by the Romans to light great cross vaulted halls as in the imperial thermæ and the Basilica of Constantine, early 4th century. In these the arched ends of the cross bays were pierced with semicircular or segmental headed windows, probably filled with grilles of bronze, and possibly glazed with glass horn or mica. In the smaller basilicas, where the central nave was higher than the surrounding side aisles, the clerestories were pierced by simple arched headed or rectangular windows, and this method of lighting the naves became the rule in the early Christian basilicas.

When it became customary to vault the church naves, difficulties in abutting the thrust led to a great diminution in the height of the clerestories and the size of the windows, or even to their entire omission. It was, in fact, the desire to get large clerestory windows that was one of the main factors in producing the ribbed groined vault, the flying buttress, and the birth of Gothic architecture. See ROMAN ARCHITECTURE; BATHS; BASILICA; ROMANESQUE ARCHITECTURE; GOTHIC ARCHITECTURE.

CLERGYMAN, one who has been regularly authorized to preach the gospel, and to administer its various ordinances. The clergyman must also administer the affairs of the parish, conduct religious services, and be a spiritual and temporal guide for the members of his church. In some denominations a clergyman holds his position for life, but in others he is transferred frequently from one church to another. Although some denominations admit and ordain women to the clergy, generally the occupation is restricted to men who have felt some "call" to work in the ministry, and sponsors are usually required. The tendency to demand at least a college degree, followed by three years of theological seminary work, is on the increase. Some churches have assistant pastors or curates, in which young clergymen may serve a highly valuable apprenticeship under the direction of an experienced pastor.

CLERMONT, a paddle wheel steamer built in 1807 by ROBERT FULTON to run on the Hudson River between New York and Albany. See also SHIPBUILDING, HISTORY OF.

CLERMONT, COUNCIL OF. Pope Urban II held a council of French clergy and nobles in Nov.

1095 at Clermont in Auvergne. Excommunication was pronounced against PHILIP I of France for the scandal of his domestic life. The Peace and TRUCE OF GOD were proclaimed. Towards the end of the meeting the Pope delivered an address in which he urged the French to undertake a holy war for the recovery of the Holy Sepulchre, an appeal which launched the First Crusade. There are four independent records of his speech by persons presumed to have been present. He urged that war against the infidel should replace wars among the Christians, that Palestine offered opportunity for colonization, and that war for the faith would expiate sin and assure salvation. Those present responded with the cry, "God wills it!" The prominent part in starting the crusade formerly assigned to Peter the Hermit is no longer accepted by scholars.

CLERMONT-FERRAND, a city of central France, formed by the union, in 1731, of the two towns Clermont and Montferrand. It was the scene of the famous Council of Clermont, in 1095, at which Pope Urban II called Christendom to the First Crusade. The Church of Notre Dame Du Port, one of the finest examples of the Romanesque architecture of Auvergne, was begun in the 11th and finished in the 13th century, but the greater part of it is early 12th century work. The most distinctive external feature is the apse, which is built with four radiating chapels; the use of polychrome masonry, and the carved cornices. The capitals of the columns, in the interior, are also interestingly carved, especially those of the choir. The crypt contains a black Virgin, probably of the 14th century, long an object of pilgrimage. The Gothic cathedral of Notre Dame has fine 13th century windows. Clermont-Ferrand is the capital of the department of Puy-de-Dôme, and the seat of a university. It is the center of the rubber industry of France. Pop. 1931, 103,143.

CLERUCHY, a type of COLONY especially used by Athens, in which the members retained their full Athenian citizenship, and were subject to the laws of the home city, thereby differing from the ordinary colony.

CLETUS, ST. (1st century), bishop or Pope of Rome, is believed to have been the second in succession from St. Peter. He is sometimes listed in annals of the popes as Anacletus, although occasionally both Cletus and Anacletus are given, probably in error. Tradition says that he governed the church in Rome from A.D. 76 to 88. He is thought to have been a Roman by birth, belonging to the quarter known as Visus Patrici. He died probably on the day now kept for his feast, Apr. 26, 88 A.D., and was buried on the Vatican hill near the body of St. Peter.

CLEVELAND, STEPHEN GROVER (1837-1908), twenty-second and twenty-fourth President of the United States, was born at Caldwell, N.J., March 18, 1837. He was the fifth of nine children of Richard Falley Cleveland, a Presbyterian clergyman of English descent, and Ann Neal Cleveland, daughter of a Baltimore publisher with French and Irish blood.

In 1841 the family moved to Fayetteville, N.Y., where Grover received a common school education, and later they removed to Clinton, N.Y., where the elder Cleveland died in 1853. Forced to shift for himself, Grover decided to seek a career in the West but on reaching Buffalo, was prevailed upon by his uncle, Lewis Allen, to live with the latter's family there. Cleveland obtained a clerkship in a Buffalo law office in 1855, and four years later was admitted to the bar.

When drafted during the Civil War, he hired a substitute in order to continue giving financial aid to his mother. In 1863 Cleveland was appointed assistant district attorney of Erie County, and in 1869 was elected sheriff. On conclusion of his term he returned to private practice until, in 1881, he was elected mayor of Buffalo as a Democrat. He immediately instituted sweeping reforms, removing politics from the granting of city contracts and introducing efficiency and economy into the municipality where corruption and extravagance had reigned. His term won him praise from both political parties.

The year 1882 found the Republican party in New York State disorganized and in disrepute as a result of recent scandals. The Democrats seized the opportunity to make an issue of corruption, and sensing the vote-getting value of a man not affiliated with its own political machine, nominated Cleveland for governor. He was elected by a record plurality of 192,854 votes over his Republican rival. As governor he displayed the same business-like efficiency and stubborn indifference to political expediency that had characterized his mayoralty administration in Buffalo. He was an ardent advocate of civil-service reforms, and supported the efforts of young Assemblyman Theodore Roosevelt for municipal reforms in New York City, thereby earning the lasting enmity of Tammany Hall. His impressive record as governor greatly enhanced his reputation for political integrity and courage. Within three years, he had risen from comparative obscurity to national prominence.

In 1884 the nomination of James G. Blaine as Republican candidate for president caused a split in that party. A faction known as the "mug-wumps," who were opposed to Blaine, proclaimed their intention to support the Democratic nominee if the latter would prove to be an independent man. The Democratic party complied by choosing Grover Cleveland for its presidential candidate. The campaign that followed was remarkable for the amount of mud-slinging freely indulged in by both sides. Weathering a widely publicized attack on his personal morals, Cleveland won the election by 219 to 182 electoral votes, and took office in March 1885.

Upon entering office, Cleveland proved his distaste for the spoils system by maintaining a non-partisan attitude in making appointments, and turned away a large number of office-seekers claiming patronage. Directing his attention to building a non-political civil service, he vigorously supported the Pendleton Bill (1883) providing for competitive examinations for government clerks. He labored unceasingly for a

downward revision of the tariff schedules, but owing to the opposition of a Republican Senate, he was unable to accomplish his end. By vetoing numerous pension bills he made himself the target of bitter criticism, and damaged his chances for reelection.

In 1888 he was renominated but lost the election to Benjamin Harrison, though he received a greater popular vote than the latter. The next year he retired to the practice of law in New York. The widespread discontent caused by the McKinley protective tariff bill of 1890 found expression in a strong movement to nominate Cleveland for a third time in 1892. He was made presidential nominee at the Democratic Convention on the first ballot, and won the election on a tariff-reduction platform, gaining 277 electoral votes to 145 for Harrison.

Cleveland was inaugurated for the second time at an extremely critical period. The nation was undergoing an industrial crisis, the treasury was nearly depleted, the gold reserve dangerously low, and the constant shrinking of the value of silver was playing havoc with the circulation of currency. The president immediately called a special session of Congress to repeal the Sherman Silver Act, under which the government had been purchasing 4,500,000 ounces of silver each month. To replenish the gold reserve, government bonds were issued to the amount of \$262,000,000. In view of the critical situation, Cleveland made no effort to carry out his pledge to push through drastic reductions of the tariff rates. He permitted the Wilson-Gorman protective tariff bill to become a law in 1894, neither vetoing nor signing it. During the great Pullman strike led by Eugene V. Debs, the president incurred wide and bitter condemnation by sending federal troops to Chicago, over the protest of Gov. Altgeld of Illinois. Within a week after the arrival of the troops, the strike was broken. In foreign affairs Cleveland was an anti-imperialist; he repudiated, 1893, the treaty of annexation with Hawaii, and enforced American neutrality during the Cuban insurrection, 1895-7. He intervened in the British-Venezuelan boundary dispute and caused both parties to submit their differences to arbitration.

In March 1897, he retired to private life. Political animosities were forgotten, and when he died at his home in Princeton, N.J., June 24, 1908, he was a highly respected and popular figure. In appearance Cleveland was short, stoutish, but impressive. He possessed an abundant energy, a strong will, and self-confidence which sometimes rose to arrogance. He courted neither popularity nor friends, but those friendships he formed were usually lasting ones. In 1886 he married Miss Frances Folsom, daughter of a former law partner, the wedding taking place at the White House. To them were born two sons and three daughters.

BIBLIOGRAPHY.—J. F. Parker, *Grover Cleveland, 1892*; R. W. Gilder, *Grover Cleveland, A Record of Friendship, 1910*; R. M. McElroy, *Grover Cleveland, The Man and the Statesman, 2 vols., 1923*.

CLEVELAND, the largest city and port of entry of Ohio and 6th largest city of the United States, is situated in the northeast section of the state on the south shore of Lake Erie at the mouth of the Cuyahoga River. It is 623 mi. west of New York and 357 mi. east of Chicago; its area covers 45,289 acres. Cleveland is at 41° 31' N. lat. and 81° 42' W. long. In 1920 the population was 796,841; in 1930, 900,429, a gain of 13% in ten years. The same year the native white population of Cleveland Proper was 66.4%, the remainder composed chiefly of Poles, Czechs, Hungarians, Yugoslavians, Germans and Italians. "Metropolitan Cleveland," which includes the suburbs of East Cleveland, Cleveland Heights, Shaker Heights and Lakewood, together with seven other cities and 43 villages beyond the municipal limits, had a population in 1930 of 1,201,455. Cleveland is the seat of Cuyahoga Co. The city records an average temperature of 26° F. in January, of 71° F. in July. The average annual precipitation is 33.82 in.

Geographic Setting. At Cleveland the shore of Lake Erie runs in a generally southwest-to-northeast direction, but the city is laid out on a plateau at right angles to the direct points of the compass. The water front is 17 mi. long and is cut by bluffs. The altitude, at the intersection of St. Clair Avenue and Ontario Street, is 659 ft. above sea level. The city has three surface levels: the narrow strip of land on both banks of the Cuyahoga, which flows through the city for 5 mi., is called The Flats; the second level comprises the plateau upon which the bulk of the business, industrial and residential sections both east and west of the Cuyahoga are built; and the third level, some 200 to 300 ft. above the second, which is largely residential. The city is located on the shore of Lake Erie at the point where railroads from the west meet to pass eastward along the narrow part of the Lake Plain. It occupies an advantageous position between the coal fields of southern Ohio, Pennsylvania, and West Virginia, and the iron ore mines of the Lake Superior district. The proximity of these raw materials, to which has been added limestone from nearby quarries, has made the city one of the largest iron and steel manufacturing centers in the world and the greatest iron ore market.

Streets and Buildings. The streets of Cleveland range in width from 60 to 132 ft., and many are generously lined with trees. Approximately 60% of the city lies east of the river. The business center is Monumental Park or Public Square, a plaza ½ mi. from the lake shore. Cleveland's transportation facilities are centered around the Public Square, flanked by the Medical Arts Building, Midland Banks Building, the Builders Exchange Building, the Cleveland Hotel, the new structure of the Hibgee Co., and the new Union Terminal which has a tower 720 ft. high. The Public Square also is the architectural center of the "Group Plan," under development since 1902; this consists of the Federal Building, Library, School Building, Public Auditorium, City Hall, County Building and the Stadium. Superior Avenue, bisect-

ing the square, is lined with the imposing structures of the Federal Building, the Cleveland *Plain Dealer* Building and the Public Library, erected in 1925 at a cost of \$5,000,000. The Cleveland Board of Education Headquarters Building, County Court House and the Union Trust Co., Ohio Bell Telephone Co. and Federal Reserve Bank buildings are noteworthy structures in downtown Cleveland. Also radiating from the Public Square in a southeasterly direction is Euclid Avenue, flanked by skyscrapers in the downtown district, and from East 22nd Street to East 40th Street known as "Millionaires' Row." In conformity with the lake shore, Euclid Avenue bends to the northeast at Wade Park, which is the site of the Museum of Art, erected at a cost of \$1,000,000.

Other buildings in the eastern section of Cleveland include Severance Hall, the new home of the Cleveland Symphony Orchestra, the Case School of Applied Science and Western Reserve University with its group of University hospitals.

Parks and Monuments. In 1930 Cleveland had 3,655 acres of parks and 45 mi. of park boulevards. The parks numbered 26. Gordon Park on the lake front has 122 acres, and 6 mi. west is Edgewater Park, with 125 acres extending 6,000 ft. along the lake front. Between these two parks the city in 1931 planned to construct a lake front airport by reclaiming land. Woodland Hills Park, occupying 113 acres, and Garfield, Lakeview, Lincoln, and Washington parks, together with Monumental Park in the Public Square, are smaller areas for recreation purposes. Rockefeller Park is a winding strip of wooded area leading from Gordon Park southeasterly to Wade Park; in the latter is Fine Arts Garden containing the well-known Fountain of Waters and the 12 signs of the Zodiac. The imposing monuments include the Soldiers' and Sailors' shaft in the Public Square, topped by a figure representing Liberty; the statue in the same plaza of Moses Cleaveland, founder of the city, and the Garfield Memorial in Lake View Cemetery, consisting of a sandstone tower 165 ft. high. See GARFIELD MONUMENT.

Cleveland's park system includes a chain of nine reservations around the outer edge of the city, totaling 10,000 acres and ranging in size from 100 to 3,000 acres. A large portion of this acreage retains its natural beauty. Hunckley Reservation is the site of a large artificial lake.

Transportation. Cleveland, an important railroad center, is served by the New York Central, the Nickel Plate, the Big Four, the Pennsylvania, Erie, Baltimore and Ohio, and the Wheeling and Lake Erie railroads. Two breakwaters built by the Federal Government make Cleveland's excellent outer harbor. With the inner harbor, made at the mouth and along slips of the Cuyahoga, facilities are provided for 45 steamship lines to all the ports on the Great Lakes; the inner harbor is flanked by ore and coal handling docks, among the most important on the Great Lakes. The street railways cover 402 mi. of streets. A bus system gives added transportation within the city.

The chief of several viaducts over the river is High Level Bridge, with a central span of 591 ft. The city is an important link in the transcontinental air mail and passenger service; Cleveland Municipal Airport, covering 1,040 acres west of the Cuyahoga, is a division of the United States Mail Service, and in 1930 was equipped with 12 hangars.

Commerce and Industry. In 1929 there were 2,251 industrial establishments in Cleveland, which manufactured products valued approximately at \$1,240,000,000. In the same year the retail trade amounted to \$534,240,787. In 1930 the wholesale trade of Cleveland, all establishments, together with Cuyahoga Co. was valued at \$1,175,022,279. The leading industrial products are iron and steel, automobiles, auto accessories and parts, airplanes, storage batteries and parts, printing presses and machinery, paints, varnishes and oils, plumbers' fixtures, chemicals, hardware, iron castings, steel forgings, packing products and clothing. Cleveland represents the Fourth District of the Federal Reserve System. Bank clearings in 1929 were \$6,637,913,334, 10th greatest among cities in the United States.

History. The first permanent trading station on the site of future Cleveland was established in 1796 by Moses Cleveland, head surveyor of the Connecticut Land Co. The district was then part of the Western Reserve, but in 1800 it became a town, and in 1809 the seat of Cuyahoga Co. A city charter was granted in 1836. During 1850-60, Cleveland was reached by the eastern railroads, and its industrial career was begun.

BIBLIOGRAPHY.—Cleveland Chamber of Commerce, *Annals of*, pub. since 1865; C. E. Kennedy, *Fifty Years of Cleveland*, 1925.

CLEVELAND, an industrial city in southeastern Tennessee, the county seat of Bradley Co., 30 mi. northeast of Chattanooga. Bus lines and the Southern Railroad afford transportation. The surrounding region is noted for its fine peaches and strawberries. Manganese, silica and other minerals are found in the vicinity. Cleveland has woolen, hosiery, flour and lumber mills, foundries, and enamel, coffin and soap factories. The houses which were the headquarters of Gen. Grant and Gen. Sherman, during the Civil War, are points of interest. Cleveland was founded in 1832 and incorporated in 1837. Cherokee National Forest is near by. Pop. 1920, 6,522; 1930, 9,136.

CLEVELAND FOUNDATION, the first community trust in America. It was established in 1914, to provide a means of accumulating and distributing funds for charitable and educational purposes to promote education and scientific research; to care for the sick, aged or helpless; to improve living conditions, and provide recreation for all classes, regardless of race, color or creed. The Cleveland Trust Company is the official trustee for the foundation and at regular intervals distributes the income from all gifts received. At present the income is being devoted primarily, aside from that given certain charitable institutions, to the Graduate School of Western Reserve

University, scholarships and student aid. In 1929 the active endowment of the foundation approximated \$3,000,000.

CLEVELAND HEIGHTS, a residential suburb of Cleveland, Ohio, in Cuyahoga Co. It was at one time the home of MYRON T. HERRICK, and John D. Rockefeller's Forest Hills estate is located here. The retail trade in 1929 amounted approximately to \$10,910,000. Incorporated in 1903, it was chartered as a city in 1922. Pop. 1920, 15,236; 1930, 50,945.

CLEWS, HENRY (1836-1923), American banker, was born in Staffordshire, England, Aug. 14, 1836. His parents planned to educate him for the ministry, but at the age of 15, while visiting in New York City, he decided to enter upon a business career and did not return to school. Requested by the secretary of the treasury, Clews sold government bonds during the Civil War, and at its close continued financial activity. In 1877 he organized the firm of Henry Clews & Company, with members pledged to eschew all unsafe speculation. He was a leader in the successful fight against the "Tweed Ring" in New York City. Clews wrote *The Wall Street Point of View* and *Twenty-eight Years in Wall Street*. He died in New York, Jan. 1, 1923.

CLICHÉ, a term used for STEREOTYPING in England and France.

CLIENT, in law, a person, corporation or institution that employs a lawyer to advise him in his business transactions, or to represent him in court proceedings.

CLIFF, a precipitous wall of rock marking the face of a rugged coast, of a dissected plateau, or the sides of a gorge or canyon. Cliffs are carved by the attack of lake or ocean waves, by the wear of running water, by weathering, or by faulting, that is, the breaking of rock strata and the upthrusting of rocky scarps. Valley cliffs, steep above, are usually masked below by debris, or talus slopes. Sea cliffs of strong resistant rock may be nearly perpendicular, and occasionally as much as 1,000 ft. high, as at North Cape. Cliffs rising one or 200 ft. are, however, not common.

CLIFF DWELLERS, prehistoric inhabitants of homes resembling Indian pueblos, in southwestern United States, built high up on the sides of canyons in natural recesses of the rock. They are now thought by archaeologists to have been the ancestors of the present Pueblo Indians, who resorted to these almost inaccessible sites for safety. They were farmers, with well-planned irrigation systems, and left interesting remains of textiles, jewelry, pottery, basketry, inscriptions on rocks, ingenious stone and bone tools and mummies, but no sign of metal working.

CLIFF DWELLINGS, abandoned and partially ruined prehistoric homes in the canyons of the southwest, especially in Colorado, Utah, New Mexico and Arizona. They were communal houses, built of stones, mortar and concrete, often several stories high and hundreds of feet long, fitting into natural recesses in the cliffs. Occasionally, in soft stone, cham-

bers were excavated. Some settlements were 100 feet above the canyon floor, accessible only by ladders, or by hand and toe holds chipped out of the rocks. The lower stories were usually entered by a hole in the roof, the upper stories being stepped back, as in the



FROM G. L. BEAM PHOTO, DENVER, COLO.

CLIFF PALACE, MESA VERDE NATIONAL PARK, COLO.

The largest of many prehistoric ruins found in the park, the Cliff Palace is 900 ft. long and is estimated to contain 200 rooms, including 23 kivas, or underground ceremonial chambers. The Round Tower is at the left center, the Square Tower at right

present pueblos, and reached by ladders. The finest examples are found in the Mesa Verde National Park and in other national reservations.

CLIFFSIDE PARK, a rapidly growing borough of Bergen Co., N.J., situated on the top of the Palisades overlooking upper Manhattan Island. It is served by numerous bus lines connecting with both the 125th Street and 42nd Street ferries, and by bus lines via the George Washington Memorial Bridge. It is purely a residential community and is a popular suburb of New York City. The retail trade in 1929 amounted to \$3,672,578. Pop. 1920, 5,709; 1930, 15,267.

CLIFTON, a rapidly growing industrial city of Passaic Co., N.J., located on the Passaic River 8 mi. north of Newark and adjoining Passaic on the north and Paterson the south. It is served by the Erie and the Lackawanna railroads, trolleys and motor buses. Its manufactures include steel, textiles, metal-ware, leather goods and chemicals. In 1929 the factory output reached approximately \$45,000,000; the retail trade amounted to \$9,544,195. It is also the trading center for a productive truck gardening area. Clifton, originally the township of Acq, was incorporated as a city in 1917. Pop. 1920, 26,470; 1930, 46,875.

CLIFTON FORGE, a city in Allegheny Co., western Virginia, on the Jackson River, 3 mi. from the head of the historic James, 46 mi. southwest of Staunton. It is served by the Chesapeake and Ohio Railroad. The city, surrounded by the beautiful Allegheny Mountains, is the market center for the hard woods found in the great forests. There are extensive railroad shops here, and a growing number of lumber mills. At the entrance to the gap, made

by the river and used by the Indians as a passage through the mountains before the white men came, is the old forge from which the city derives its name and from which material for ammunition was carried on bateaus during the Civil War. Pop. 1920, 6,164; 1930, 6,839.

CLIFTON HEIGHTS, a borough in southeastern Pennsylvania, in Delaware Co., situated on the Baltimore Pike, 6 mi. from the center of Philadelphia; it is served by the Pennsylvania Railroad (southern division). Clifton Heights is an industrial community making textiles, hosiery and towels. Pop. 1920, 3,469; 1930, 5,057.

CLIMACTERIC or climacterium, a period in life when great physiologic changes take place. In women such epochs occur when menstruation begins and when it ends. However, the term climacteric is almost entirely restricted to that period in the life of a woman known as the "change of life" or the menopause. This period marks the termination of a woman's reproductive life and its most prominent evidence is the cessation of the monthly flow of blood. Other symptoms are transitory hot flushings of the head and neck, sweating, increase in weight and change in temperament manifested by nervousness, irritability and crying spells. Women who are cold, apathetic or accustomed to hardships complain little of the symptoms which arise during the menopause, but sensitive individuals are considerably upset by the disagreeable features of this period of life. The age at which the climacteric occurs varies considerably, but in the temperate climate menstruation generally ceases between the ages of 40 and 50. Contrary to the prevalent notion the earlier the menstrual function is established the longer it continues. The climacterium may be produced artificially by removing the ovaries surgically or by treating them with radium or the Roentgen rays. In many cases, but not all, the symptoms of the climacterium can be relieved by medication.

J. P. G.

CLIMATE, the average condition of the atmosphere taken over a long period of time, as contrasted with **WEATHER** which is the temporary condition. It is of the greatest influence upon the life of man, its most important aspects in this connection being the average amount of sunshine, the temperature, humidity, and wind velocity and their extreme ranges. The air pressure is of only minor consideration. As climate on the earth is governed chiefly by the sun, the determining factor in the climate of any locality is its latitude; the second factor is its position with respect to the division of land and water, and the third the smaller, local conditions, such as mountain ranges, ocean currents, prevailing winds.

Owing to the first influence, the average temperature decreases with an increase in distance from the equator. The pure solar climate would be a simple latitude climate, where the tropical belt, the temperate zones and the polar cap would possess a uniformly changing climate. The presence of large bodies of water, owing to their slowness in absorbing and

radiating heat, retards and moderates the severity of the solar climate. Thus a marine or oceanic and a continental type of climate may be distinguished, where the former has warmer winters, colder summers, and a smaller range in temperature than the latter.

The climate of the coast regions of the continents are furthermore dependent upon whether the prevailing winds are from the oceans or off-shore. Since in general the winds are westerly in the temperate zone, due to the rotation of the earth, the western coasts of the continents have a marine-like climate, the eastern coasts a continental-like climate. The western coasts possess still further advantages in often having warm ocean currents to moderate the winter cold, such as the Gulf Stream which causes the temperature of northwestern Europe to be considerably higher than the mean for its latitude, and the climate to be milder than that of the eastern shores of Asia. Similarly, the Pacific coast of the United States and Canada enjoys a much less severe climate than the Atlantic seaboard.

As a result of the various combining and opposing influences the surface of the earth may be divided roughly into eight climatic zones, viz., the tropics, which are very warm and moist; two comparatively dry subtropical zones blown dry by the TRADE WINDS, and containing most of the large desert tracts of the globe; two warm, temperate zones where the temperature does not often fall below freezing; one boreal zone with heavy winter snowfalls and great forests, existing in the northern hemisphere but not in the south, because of the absence there of large landmasses; and finally the two polar caps or arctic regions.

An important modifying feature of climate is the humidity, high relative humidity being more pleasant at medium temperatures, while low relative humidity considerably moderates the effects of extreme temperatures. Altitude is another influence upon climate, for although the direct effect in decrease of pressure does not become readily noticeable except at very high altitudes, the consequent decrease in temperature and in relative humidity may produce a considerable change.

The climate all over the earth is subject to minor fluctuations during the course of centuries. Whether these changes are progressive and may in time alter certain climates radically is as yet impossible to say, although there are some indications that such is the case, as for example the gradual drying up of the northern part of the Kalahari in South Africa. During geological ages climates have greatly altered as is evident from the records left behind by the various ice-ages. It furthermore appears probable that during the past 5,000 years the rainfall and temperature of certain regions in western Europe have undergone marked changes.

W. J. L.

CLIMATE, ARTIFICIAL, an artificial air condition maintained indoors independent of the outside weather, and brought about by AIR CONDITIONING.

CLIMAX, progression of ideas or details from weak or less significant to strong or more significant, e.g., "wealth, happiness, life itself." Strictly speaking, climax is this grading of elements, although the point of highest interest toward which the grading is directed is also sometimes called the climax, particularly in narrative. The opposite effect, or anti-climax, results when the moment of highest intensity is allowed to degenerate into one less significant, or when strong elements are succeeded by weak.

BIBLIOGRAPHY.—H. Blair, *Lectures on Rhetoric and Belles Lettres*, 1820; A. Bain, *English Composition and Rhetoric*, 1872.

CLIMB INDICATOR, an instrument showing the rate of climb or descent of an AIRPLANE; it does not indicate angles. The climb indicator is dependent upon changing atmospheric pressure for its actuation. It consists of a case containing a diaphragm, one side of which is connected directly to the outside air and the other side of which is connected to the air through a capillary "leak" tube. The pressure on one side of the diaphragm changes as the outside pressure changes, while the pressure on the other side changes slowly, giving a differential pressure proportional to the rate of climb or descent.

CLIMBING FERN, a genus (*Lygodium*) of elegant mostly warm country ferns, comprising about 20 species with more or less twining stems, several of which are widely grown in greenhouses for their beautiful, much divided foliage. See also HARTFORD FERN.

CLIMBING FISH (*Anabas scandens*), also known as climbing perch, a fresh water fish found in India, Burma, and the Malay Islands, is noted for the presence of complicated air spaces within the gill cavity, permitting it to live in muddy places, or out of the water, and breathe air for periods of two or three days. Fragile bony plates, surrounded by a moist membrane, form the cavities. The scaly body about 7 in. long has a spiny dorsal fin. Climbing fish are said by the natives to ascend sloping palm trees growing on the edge of lakes, when the water runs down them during the rainy season. It is also claimed that they travel overland in the early morning and at night, on account of the greater moisture in the air, in order to leave a drying pool and search for new waters. They move by means of spiny opercula, which are membranous bones on the sides of the head. There are other members of the family (*Anabantidae*) all living in Asia and South Africa. Mollusks and insects are their chief foods.

CLIMBING FUMITORY (*Adlumia fungosa*), a delicate climbing plant of the fumitory family, called also mountain-fringe and Allegheny vine. It is a native of rocky woods from Ontario to Michigan and southward to North Carolina, often cultivated for its highly ornamental foliage and drooping clusters of purplish flowers. It is biennial, propagating readily from seeds.

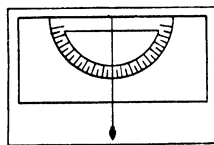
CLINKER, in industry, fused residues of coal formed in lumps in grates and furnaces; also, fused masses of brick occurring in brick ovens. In metal-

lurgy, scales of oxide of iron formed when iron is heated in air, and the slag of iron furnaces are clinkers.

CLINKER BUILT. See **BOAT DESIGNING AND BUILDING.**

CLINOGRAPH, an instrument for determining the variation of bore-holes (see **DRILLING**) from the true vertical. It consists of a section of pipe, sealed tightly and which is lowered into the hole. The direction or "bearing" of the pipe is obtained by placing a compass needle attached to a piece of cork inside the tube and partly filling the tube with liquid gelatine. The tube is left in place until the gelatine has hardened, during which time the needle assumes the direction of the magnetic meridian. The angle of dip is found either by suspending a plumb bob in the gelatine or by placing a glass tube, partly filled with hydrofluoric acid, inside the large tube. The angle at which the plumb bob stands, or the angle of the line where the acid eats the glass, gives the angle of dip of the bore hole.

CLINOMETER, an instrument used to measure angles of elevation and depression. It is used by geologists to determine the dip of beds or strata, and by engineers to find the slope of embankments and other works.



SIMPLE FORM OF CLINOMETER

Some clinometers are graduated in degrees while others show the per cent of slope. The word clinometer is from the Greek *klino*, to slope, and *metron*, measure. A simple clinometer may be constructed by tacking a protractor to a rectangular piece of board and suspending a plumb bob from the center as shown in the figure. The carpenter's or mason's spirit level or plumb is really a simple form of a clinometer giving only two angles, 0° and 90°.

CLINTON, DE WITT (1768-1828), American statesman, was born at Little Britain, N.Y., Mar. 2, 1769. He was educated at Kingston Academy and Columbia College, graduating from the latter at the head of his class in 1786. While studying law for three years, in 1787 he published a series of letters opposing the Federal Constitution. In 1790, the year of his admission to the bar, he became private secretary to his uncle, George Clinton, the governor of New York, and also secretary to the Board of Regents and the Board of Fortifications. He was turned out of office together with the Republicans in 1795, when he undertook a study of natural science under the direction of two prominent Columbia professors. In 1797 he was elected to the Assembly and in 1797 to the state Senate. Four years later Clinton was elected as one of the four senators who composed the Council of Appointments, and as dominant member he proceeded to replace Federalist officeholders by Republicans and thus earned the reputation of originating the spoils system, although the practice was not new. In 1802, Clinton was appointed

to fill a resigned seat in the U.S. Senate but in 1803 he resigned from that office to become the mayor of New York City, an office he filled continuously until 1815 except for two terms (1807-08 and 1810-11). As mayor he worked incessantly and efficiently for the betterment of the city and during his incumbency served also as state senator (1806-11) and as lieutenant governor (1811-12).

The factiousness of New York State Republicans brought Clinton the reputation of party insurgency and his endorsement for the presidency by the Federalists in 1812, after he had been nominated by the Republicans of the New York legislature. He carried most of the northeastern states but was defeated by Madison by 128 electoral votes to 89. The Republicans rebuked him for his Federalist association by not renominating him for governor and in 1815 he lost the mayoralty. Clinton had been appointed a canal commissioner in 1810 and had unsuccessfully attempted in 1811 to obtain Federal aid for a canal across the state which would connect the Hudson River with Lake Erie. In 1816 Clinton vigorously set to work to arouse popular support for the undertaking as a state enterprise. He went to Albany to urge the acceptance of his lengthy plan which described the engineering requirements of the project and prophesied the commercial benefits to the state. After the adoption of the plan by the legislature in 1816 a new canal commission was appointed of which Clinton was a member. Elected governor in 1817 by the Republicans, he was reelected in 1820, and served until 1823, not being a candidate again in 1822.

During these two terms as governor he diligently directed the construction of the canal and most appropriately he was again elected governor in 1825 the year that the canal was opened. An account of his political career does not adequately describe the many-sided activities of the man. Always interested in educational projects, he organized the Public School Society of New York City; he was a member of many scientific, literary and fine arts societies, being recognized as a talented author and scientist. He served as the second president of the American Academy of Art and in 1817 as president of the New York Historical Society. He died at Albany, Feb. 11, 1828. S. McK.

CLINTON, GEORGE (1739-1812), fourth Vice-President of the United States, was born at Little Britain, N.Y., July 26, 1739. He fought in the French and Indian War in 1758, then practiced law in the Province of New York. He urged the cause of the Colonies in the years prior to the Revolution, and during the war was a notably popular and successful military leader. He was a member of the second Continental Congress in 1775. In 1777 he became first Governor of New York State, and remained in that office until 1795 when he refused to be a candidate again. He sat as president of the New York Convention for the ratification of the federal Constitution in 1787, where his powerful posi-

tion as governor and leading anti-Federalist nearly defeated ratification by New York. He retired for a brief period but reentered politics and in 1801 was elected to serve his seventh term as governor of the state. He became Vice-President of the United States in 1805, and held that office until his death at Washington, D.C., Apr. 20, 1812.

BIBLIOGRAPHY.—*Public Papers of George Clinton*, 6 vols., published by the State of New York.

CLINTON, SIR HENRY (c. 1738-95), British general, was son of Admiral George Clinton, governor of Newfoundland (1732-41), where he was born about 1738. While his father was British governor of New York (1741-51), the young man served in the New York militia, acquired further military training in Europe, and took part in the Seven Years' War. He was member of Parliament when, in 1775, he was sent back to America. He led British contingents at the battles of Bunker Hill and Long Island, taking possession of New York upon the withdrawal of the American troops after the latter battle, August 27, 1776. For his victories in this battle he was made lieutenant-general and knighted, and after Burgoyne's defeat at the Battle of Saratoga (Oct. 7, 1777), he became commander-in-chief of the British army in North America (1778). He invaded South Carolina and took Charleston, May 12, 1780. After the surrender of Cornwallis at Yorktown, Oct. 19, 1781, Clinton was relieved of his command and in 1782 returned to England. He resumed for several years his seat in Parliament and in 1794 was appointed governor of Gibraltar. He died there, Dec. 23, 1795. The Clinton Papers are now in the possession of The Clement's Library at Ann Arbor, Mich.

CLINTON, a city near central Illinois, the county seat of De Witt Co., on Salt Creek, 23 mi. south of Bloomington. Bus and truck lines and the Illinois Central Railroad afford transportation. The city is in a rich grain-growing region, producing especially fine corn. The local industries include the manufacture of clothing, ice and butter. Clinton was founded in 1830 and incorporated as a city about 1853. Pop. 1920, 5,898; 1930, 5,920.

CLINTON, a city in Vermilion Co., western Indiana, situated 15 mi. north of Terre Haute on the Wabash River and served by the Chicago and Eastern Illinois Railroad. There are coal fields in this region and the city manufactures machinery, flour, furniture and various other products. It is in a good farming district. Pop. 1920, 10,962; 1930, 7,936.

CLINTON, a city in eastern Iowa, the county seat of Clinton Co., situated on the Mississippi River, 138 mi. west of Chicago. Bus and truck lines, river craft and six railroads serve the city. An emergency landing field on the Transcontinental Airway is located here. Clinton is surrounded by fine farming land, growing chiefly corn, small grain and hay. The city is an industrial center, producing furniture, wire screens, and corn and metal products. In 1929 the manufactures reached an approximate total of \$26,000,000; the retail trade amounted to \$15,446,460. It

was once a great lumber mill center. Wartburg College has its seat here. An attractive park extends along the river front. Maquoketa Caves and State Park are near by. The Iowa Land Co. settled the site of Clinton in 1855. Pop. 1920, 24,151; 1930, 25,726.

CLINTON, a town and village in Worcester Co., eastern central Massachusetts. The village is situated on the Nashua River, 15 mi. northeast of Worcester and is served by two railroads. The town is an industrial community with worsted, carpet, velour, steel and wire mills, publishing plants, chair works and meat packing. It has an industrial output worth about \$16,530,655 annually. Cotton manufacture began in 1813, but the first modern mill was built in 1838 to make coach-lace. Horatio M. Bigelow and his brother Erastus B. Bigelow, inventors of power-looms for making figured textiles and wire-cloth, built gingham mills in Clinton in 1843, and later erected a carpet factory. Clinton was founded in 1645 and the town was set off from Lancaster in 1850. Pop. 1920, 12,979; 1930, 12,817.

CLINTON, a city in western Missouri, the county seat of Henry Co., situated on the edge of a prairie, 39 mi. southwest of Sedalia. Two railroads serve the city. The leading interests of the vicinity are farming and stock raising. There is some coal mining. Chicken hatching and flour milling are the city's chief industries. Clinton was founded in 1836; incorporated in 1865. Pop. 1920, 5,098; 1930, 5,744.

CLINTON, a city in Custer Co., western Oklahoma, situated on the Washita River, 80 mi. west of Oklahoma City. The city is a railroad center, served by five lines. Bus service is also available, and there is an airport. Cotton, corn and wheat are the chief crops of this region. The manufacture of cottonseed oil products is the principal industry. The city has also grain elevators, cotton gins, meat packing houses, a brick factory and chicken hatcheries. Near Clinton is the scene of Gen. George A. Custer's last battle with the Indians. Located here are a State Tuberculosis Sanatorium and a new Government Indian Hospital. Clinton was founded in 1905. Pop. 1920, 2,596; 1930, 7,512.

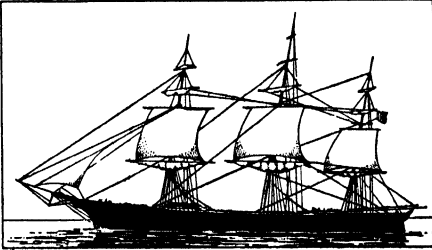
CLINTON, a city in Laurens Co. in northwestern South Carolina, situated 66 mi. northwest of Columbia. Bus lines and two railroads serve the city. Cotton, grain and peaches are the chief crops of the region. Cotton and cotton seed products, silk and electrotyping are among the principal industries. Clinton is the seat of the Presbyterian College of South Carolina, Thornwell Orphanage, and the State training school. The city was founded and incorporated in 1855. The Battle of Musgrove Mills and the Massacre of Hays Station took place in the vicinity during the American Revolution. Pop. 1920, 3,767; 1930, 5,643.

CLINTONIA, a genus of beautiful plants of the lily family, named after Governor De Witt Clinton, native to North America and eastern Asia. They are stemless perennials with creeping rootstocks, naked flower-stalks surrounded at the base by a few

broad leaves, lily-shaped flowers and smooth round berries. Four species occur in the United States: two, the yellow clintonia (*C. borealis*) and the white clintonia (*C. umbellulata*) in the eastern states and Canada, and two, the pink clintonia (*C. Andrewsiana*) and the bride's-bonnet (*C. uniflora*), on the Pacific coast.

CLIO, in Greek mythology, one of the nine Muses.

CLIPPER SHIPS, a term given to fast sailing ships, noted for their fine lines and large sail area, built during the period of 1840 to about 1869 in the United States for trading with the Far East, particularly China, also for carrying supplies to California during the gold rush. The development of



THE CLIPPER SHIP "RED JACKET"
Redrawn from a *Carrier and Lives* print of 1855

steam propelled vessels, that could be economically run, drove the clipper ships out of business. Among the famous clipper ships may be mentioned, Flying Cloud, Lightning, Red Jacket, Nightingale and Cutty Sark, the latter reported as having made 360 miles in 24 hours.

BIBLIOGRAPHY.—O. T. Howe and F. C. Matthews, *American Clipper Ships*, 1833-58.

CLIVE, CATHERINE (KITTY) (1711-85), English actress, was born at London in 1711. Her first rôle was in 1728 when she appeared as a singing page in *Mithridates*. In Colley Cibber's *Love in a Riddle*, 1729, she played Phillida, and in 1731 appeared in Charles Coffey's *The Devil to Pay*. She played Delilah in the first production of Handel's *Samson*, 1744. At her last appearance, in 1769, DAVID GARRICK, as a compliment to her long association with him, took a secondary rôle. Her wit and good sense made her the friend of many notables, among them Horace Walpole, who presented her with a house on Strawberry Hill, Twickenham, London, where she died Dec. 6, 1785.

CLIVE, ROBERT, BARON (1725-74), British statesman, was born in Shropshire, Sept. 29, 1725. In 1743 he entered the service of the East India Company as a writer, resigning after three years to join the army. Because of ill health he visited England in 1753, but in two years was again in India, this time as a lieutenant-colonel. News reached him that the Nabob of Bengal had captured Calcutta, and had smothered to death many English soldiers in what was afterwards called the "Black Hole."

Clive at once took steps to revenge this outrage, and compelled the Nabob to surrender in 1757. However, fighting soon started again, and Clive's army decisively defeated the Nabob in the Battle of Plassey, June 23, 1757. After this victory he was appointed Governor of Bengal, and on his return to England was made Baron Clive, Baron of Plassey. He again went to India this time as ruler, but because of ill health he returned to England in 1767, where he was accused by enemies of using his authority for his own enrichment. As the result of suffering and worry he committed suicide in London, Nov. 22, 1774.

CLOCKS, instruments for measuring and indicating the time of day. A clock usually consists of two parts: a mechanism for transmitting a force produced by a spring, weight or electric motor; and a mechanism for uniformly regulating expenditure of the force. The first part comprises a train or set of toothed wheels and the second an oscillating device, as a pendulum, together with an escapement. The escapement is a ratchet-like mechanism which alternately catches and releases the teeth of the last wheel of the train, the scape wheel, and at the same time imparts an impulse to the oscillating member to keep it going. This oscillating member, in turn, operates the escapement, releasing the scape wheel at regular intervals so that it rotates the distance between two adjacent teeth and causes the hands of the clock to be moved through a corresponding distance. The hour hand of the clock is connected to a wheel making one revolution in twelve hours; the minute hand is geared to the hour hand in such a ratio that it moves twelve times as fast. Both hands are driven through friction gearing so that they may be moved to "set" the clock.

The striking mechanism of clocks usually comprises a separate train of wheels which actuate a hammer so that it strikes a bell. The length of time which this mechanism operates, and, consequently, the number of times the bell is struck, is controlled by the position of the hour hand.

Springs used to operate clocks comprise a long flat piece of spring steel in the form of a spiral. When the clock is "wound up" the spiral is compact and the spring tends to unwind itself, or to take its original shape, exerting a force which rotates the drum in which it is contained. When weights are used, they are attached to the end of a string, usually of cat gut, which is wound about a drum. The force of gravity acting on the weight rotates the drum.

The vital part of the clock is the escapement mechanism. The balance escapement, operated by a rod with bodies of equal mass on each end, was the first used. From this was developed the pendulum, essentially the balance with one weight taken off. Then the balance wheel operated by a small spiral spring, as used in **WATCHES**, was introduced, and a modification of that is the balance wheel operated by a helical spring, used in **CHRONOMETERS**.

In addition to the clocks mentioned above, there

are electric and pneumatic types. There are two general types of electric clocks. One has electricity as its independent motive force and the other is regulated from a primary clock by periodical setting or by direct secondary operation. The latter type is simply a dial without independent machinery. The modern independent electric clocks are motivated by a small synchronous electric motor (*see* MOTOR, ELECTRIC) which operates on ALTERNATING CURRENT in direct synchronization with the central-station generator (*see* ELECTRIC GENERATOR). Most of the central stations keep their current FREQUENCY constant within very small limits, which provides for accuracy in the clocks. Pneumatic clocks are used with a central, or master, clock which controls them by compressed air. The master clock sends out pulsations of air through tubes to a bellows in each of the clocks of the system, causing the bellows to expand and move the hands forward.

There is no record of the date or inventor of the first clock. Some writers have credited the Chinese with the development of a mechanical timepiece as early as 2000 B.C.; others give the honor to the Germans of the 11th century and some to the Romans of the 10th century. It is certain that they came into use in Europe in the 13th century, a clock being put up in a tower at Westminster in 1288. One installed in the tower of the palace of Charles of France in 1397 was constructed on the same principle as the modern clocks. For the most part, these early clocks were manufactured by jewelers, locksmiths, blacksmiths, priests and astronomers, and they were made entirely by handiwork. When clock making was introduced in America, it took on a different aspect. Eli Terry, the first important pioneer of the industry, used machinery for the first time in clock making. Seth Thomas, one of his helpers, later established the industry on a factory basis. These first clocks were made of wood and were clumsy and costly. Chauncey Jerome saw the advantages of using brass instead of wood and organized a company which succeeded in producing clocks for the low sum of \$5 to \$6 each. The industry has developed until clocks are turned out by some companies in the United States at the rate of 5,000 or more daily. Alarm clocks and watches can be purchased as low as \$1.00, and these will keep time accurately enough for all household purposes.

CLOCKS, ASTRONOMICAL, usually pendulum clocks kept in an underground vault, where the temperature remains nearly constant, and sometimes even in an airtight compartment. The older clocks were driven by a weight wound by hand at stated intervals. Lately, however, these have been replaced by much more accurate clocks, where the weight is very small, and automatically rewound by electricity every half minute. The dial of an astronomical clock always has a very large second hand, and indicates hours from 0 to 24. For driving clocks, *see* TELESCOPE.

CLOISONNÉ, a form of Chinese enamel made by soldering a design of thin metal bands or *cloisons* on the metal base of the object to be decorated. This

design divides the field into shallow cells into which is forced varicolored enamel that has been powdered and moistened. When this process is completed, the object is fired. Under heat the enamel shrinks and becomes pitted, so that the process must be repeated several times. After firing, the enameled surface is ground down and polished. The metal tracings of the design and the parts of the object which have not been enameled are gilded.

CLOISTER, strictly, a courtyard surrounded by covered arcades or galleries forming part of a monastic community, or attached to a cathedral or cathedral church; more loosely, a monastery or ABBEY. In large monastic groups there were often two or more cloisters. The larger, the general center of monastic life, was usually bordered on the north by the nave wall of the monastic church, and on the other three sides by the church transept, refectories, dormitories and chapter house. In Cathedral churches the cloister is usually to the north of the church nave, instead of to the south, as in monasteries; from it opened the residences of the canons. Thus, the word cloister was often employed to describe the entire area used for residence purposes, and for the necessary service elements in connection with a cathedral, irrespective of whether or not a true arcaded court existed or not. Frequently such a cloister was merely an undistinguishable part of a town, though usually surrounded by walls, and there are many records of friction between secular and ecclesiastical authority with regard to its control or uses.

The typical monastic cloister, as the center of the monastic life, was given the most beautiful architectural treatment possible. In Romanesque times the roof was usually a simple sloping timber structure, supported by arcades of small colonnettes often raised on a broad stone base which formed a bench. Frequently in order to give greater rigidity to the supporting arcade, the columns were doubled, one behind the other, and capped by a single richly carved capital. In many examples, further strength was given by dividing the arcade into bays of three or four arches, these being separated by heavy rectangular piers.

In the 12th century the cloister galleries were more frequently vaulted, first with barrel vaults and later with groined or intersecting vaults. With the development of the Gothic ribbed vault typical Gothic vaults and pointed arches came into use. At the same time, in order to give the greatest protection to the covered portion, it became usual to subdivide the Gothic arches with typical window tracery and to glaze the upper sections, leaving the lower sections open. Among the richest and most effective of the Romanesque cloisters are those of Le Puy en Velay, 10th and 12th century, remarkable for its polychrome masonry; Moissac, about 1100 and 1188, with rich carved capitals; Elne, 1175, with later restorations, and St. Trophime at Arles, about 1200, incorporating earlier fragments. The cloisters of San Giovanni in Laterano and San Paolo fuori la mura in Rome show the persistence of classical elements, and are unusually

lavish and beautiful examples of the intricate mosaic work of 13th century Rome developed by the Cosmati.

Characteristic Gothic cloisters are those of Fontfroide, transitional, 12th century; Laon, beginning of the 13th century, with glazed plate tracery; Sémur en Auxois, 1230-40, with glazed bar tracery; St. Jean des Vignes, 1240, with glazed plate tracery and extraordinarily rich decoration; Mt. St. Michel, 13th century, Norman, unvaulted, and with a most ingenious colonnette arrangement and many English features; Salisbury and Lincoln, in England, both rich examples of geometric tracery; and in Spain, the magnificent late Gothic cloister of Belem, 16th century.

The most interesting of the Renaissance cloisters are those of the Certosa at Pavia, 15th century, and the exquisitely graceful cloister of Santa Maria della Pace in Rome, by Bramante, 1503. T. F. H.

CLOISTER AND THE HEARTH, THE, a historical novel by CHARLES READE; published 1861. The scene is laid chiefly in Holland and Italy at the close of the 15th century. When the marriage of Margaret Brandt and her humble lover Gerard, is prevented, Gerard flees to Rome and there becomes a monk upon hearing of Margaret's death. Later, however, returning to Holland, he learns that Margaret still lives and that she has a son, but is himself powerless to leave the Church. It was the son of Margaret and Gerard who grew up to be the great scholar, Erasmus.

CLON, a group of plants or animals all of which have originated from a single individual by asexual propagation. In the lower organisms which are unicellular, or chiefly so, repeated cell-division leads to the development of clons often of large extent; in many groups of animals sexual reproduction is the rule; and in the higher plants clonal propagation becomes highly important and the clon is prominent as a unit both in nature and in horticultural practice. Nearly all the important fruit crops, certain of the root and tuber crops, and a long list of perennials among ornamentals are propagated exclusively by vegetative means. In such plants a distinctly new sort arises as a seedling of sexual reproduction or as a bud mutation. This is then propagated asexually to give a clon all members of which are, in a sense, merely parts of the same plant with the same inherent constitution. The clon is hence distinct in nature and origin from a variety grown from seeds, the formation of which involves sexual reproduction.

There are certain advantages in clonal propagation. Usually it gives an easy and rapid means of multiplying plants; thus it is far easier to obtain plants from the runners of the strawberry or from the cuttings of a grape than it is to grow new plants from seed. Also many cultivated plants are complex hybrids which do not breed true from seeds. Very often vegetative propagation by division, layering, cutting, budding, or grafting is the only way that individual seedlings of merit can be perpetuated and increased in number. Thus the clon insures the greatest uniformity possible in crop production.

The culture of clons gives rise to certain problems. Various virus and mosaic diseases are perpetuated by clonal propagation. Among crops grown for their fruits, nuts, or seeds, many clons require interplanting to provide proper cross-fertilizations necessary for fruiting. Among some plants there is considerable bud sporting and it is necessary for the horticulturist to practice selection in propagation.

In the older botanical literature, Latin names were frequently given to clons as well as to true varieties, but this treatment leads to considerable confusion. The special and individual nature of the clon is best expressed by a non-Latinized horticultural name that in its usage approaches the rank of a proper noun. When there is a close relation to a species or a variety the clonal name may be written in connection with the proper scientific name; as for example *Populus alba* clon Bolleana. In case the specific relationship is remote or involved, the cultivated clon may be named merely the Baldwin apple, the Ambassadeur Iris and the like. A. B. S.

CLONMEL, county town and municipal borough of County Tipperary, Irish Free State, lying in a fertile valley on both banks of the Suir, on Moor and Long Islands, 112 mi. southwest of Dublin. The place-name, *Cluain Mealla*, or Vale of Honey, indicates the beauty of its river and mountain-skirted environs. As a medieval walled town and the seat of a Franciscan friary founded in 1269, it was of some importance until captured and dismantled by Cromwell. Fragments of the early walls survive along with an ancient round tower and the cathedral that was once burned by the Earl of Kildare on the excuse that he thought the Archbishop was within at the time. Situated at the head of barge navigation in the Suir, the town has some transport and agricultural trade. Pop. 1926, 9,056.

CLOQUET, a city in Carlton Co., northeastern Minnesota, situated on the St. Louis River, 27 mi. southwest of Duluth. Four railroads serve the city. Lumber is the chief resource of the region, and the city is the leading woodworking center in the Northwest. The industrial establishments include lumber and paper mills and box and wood-working factories. The site was settled about 1879 and called Knife Falls; in 1886 the city was laid out and renamed Cloquet. In 1918 the city was destroyed by a forest fire. Pop. 1920, 5,127; 1930, 6,782.

CLOSED PORTS, UNITED STATES AND POSSESSIONS. The following naval harbors by executive order have been closed to foreign vessels. Tortugas, Fla.; Great Harbor, Culebra; Guantanamo Naval Station, Cuba; Pearl Harbor, Hawaii; Guam; Subig Bay, Philippine Islands; Kiska, Aleutian Islands.

These harbors cannot be visited by any commercial or privately owned vessel of foreign registry, or any foreign naval vessel, except by special authority of the United States Navy Department in each case.

CLOSED SHOP, a term employed in the United States to denote a place of employment in which only union labor is employed. (See LABOR ORGANIZATION.)

The "open shop" theoretically is one in which both unionists and non-unionists may work without discrimination. The latter has been termed by some employers "the American plan." These terms are misleading, however, since a shop which is closed to union labor and employs only non-union workers is also called an open shop. Since organization is the point at issue, trade unionists prefer the terms "union shop" and "non-union shop," a "union shop" being one in which conditions of work are fixed by collective agreement (see COLLECTIVE BARGAINING) with the union, although the workers may or may not all be union members; a "non-union" shop being one in which the union is not recognized and in which conditions of work are determined by individual agreement.

Both union shops and non-union shops may be open, closed or preferential. An open shop may be operated by employers who bargain collectively with unions or by those who refuse to recognize them, i.e., they may employ union workers although they refuse to recognize the union and they may employ non-union men although they have a contract with the union which determines wages and conditions under which all their employees work. A closed shop may exclude either union or non-union workers. A preferential non-union shop gives preference to non-union workers, with the result that union workmen are kept in the minority. A preferential union shop recognizes and gives preference to union workers.

The closed union shop prevails in the larger cities in the smaller competitive trades in which workers are highly skilled and where the union is well organized. The building, mining, printing and newspaper trades are perhaps most representative. In some of the larger industries, notably metal, the closed non-union shop prevails.

Most employers state their preference for the open shop in which both union and non-union men are employed, often meaning thereby the open shop in which the worker is hired on an individual basis. As a matter of fact, although the employer may wish to maintain a true open shop, if he employed a large number of active union men and permitted union organization in his shop, he would soon have a majority of his men organized and be forced to recognize the union. Thus so long as the union exists in the industry and the employer wishes to keep it out of his shop, he must of necessity, regardless of his declarations or intentions, discriminate against the union.

Most trade unionists prefer the closed union shop, on the ground that they are able thus to maintain union standard of wages and conditions of labor through collective agreement. One of the objections of employers to the closed union shop is that it may be enforced by a closed union, i.e., by one which limits its membership, thus restricting the labor supply. The closed union shop of the closed union represents one extreme, the closed non-union shop, the other.

The closed and open shop are indigenous to the

United States. They are practically unknown in foreign countries where, because of the higher degree of unionization, and the homogeneity of the working class, there seems to be no question of union recognition.

P. F. B.

BIBLIOGRAPHY.—Douglas, Hitchcock and Atkins, *The Worker in Modern Economic Society*, 1923.

CLOSURE or CLOTURE, the generic name given to the various techniques of shutting off debate in a representative assembly. Closure has practically never been used in the United States Senate except upon occasion during the World War, but in the House of Representatives it is frequently resorted to in order to speed legislation and crush minorities.

BIBLIOGRAPHY.—C. A. Beard, *American Government and Politics*, 1924.

CLOTHES DRYERS. "Hot-air" dryers are metal cabinets equipped with wooden drying racks and a source of heat, either gas or electric. The cabinet is so designed that the warm air circulates evenly about the clothes. "Centrifugal" dryers consist of a drum inside of which a perforated cylinder, containing the wet clothes, rotates at a high speed, the moisture being thrown out by centrifugal force (see CENTRIFUGAL FORCE). To date, only a small percentage of homes possess clothes dryers. See also LAUNDRY EQUIPMENT.

CLOTHES MOTHS, a family (*Tineidae*) of lepidopterous insects, whose larvæ feed on woolen fabrics, furs and similar articles. At least three species in the United States are highly destructive. *Tinea pellionella* is a small, brown moth; *Tinea tapetella*, the tapestry moth, has dark gray head and hind wings, the forewings being black and yellowish white; and *Tinea biselliella* is a straw-colored species. The tiny white eggs are laid on the fabrics, in dark, warm places, and they hatch in a short time into the larvæ which do the damage. Cold (40°-42° F.) stops the development of the larvæ. Naphthalene flakes scattered on the fabric are useful repellants.

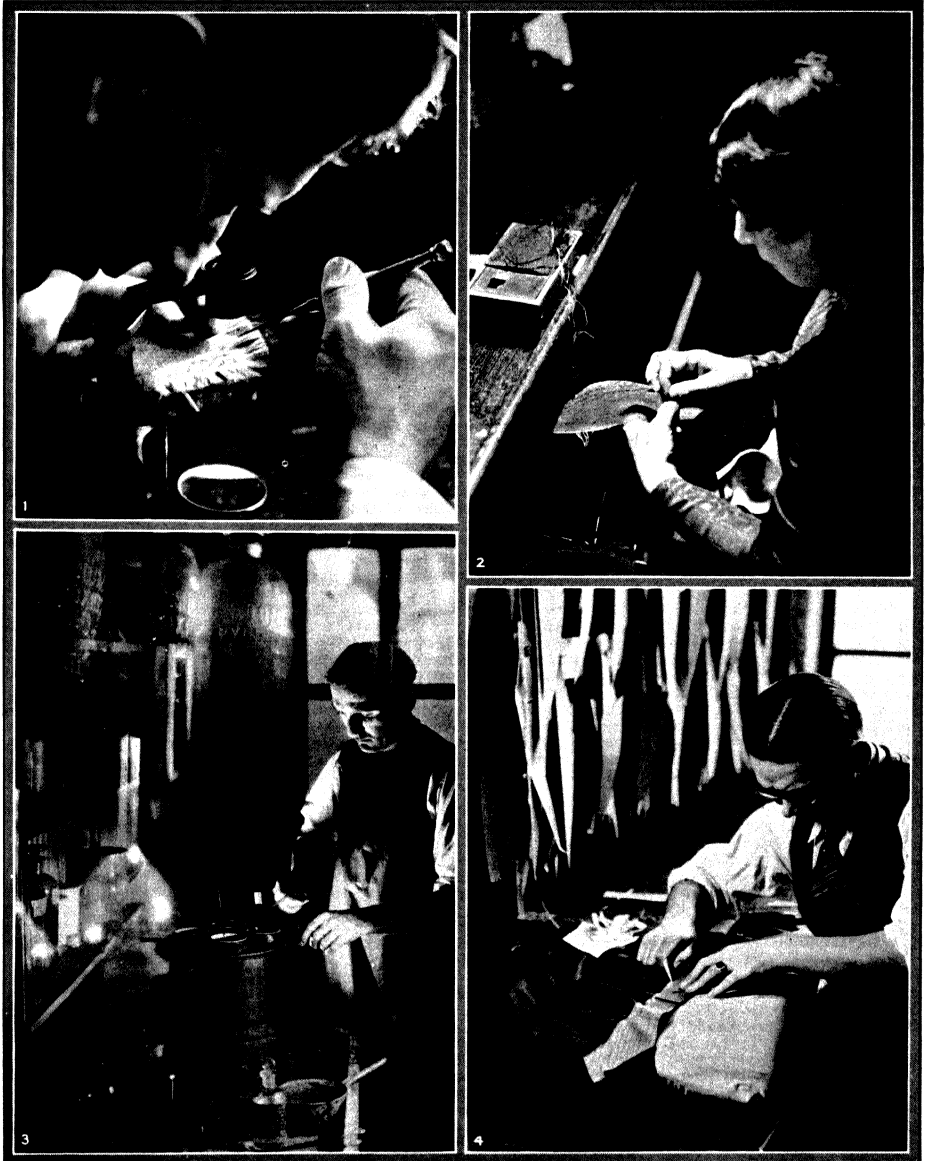
CLOTHING INDUSTRY, UNITED STATES. Since 1923 the Census of Manufactures has presented comparable statistical information regarding this extensive industry under three main divisions, namely, (1) men's clothing, (2) men's work clothing, and (3) women's clothing. In 1929 the total output of the establishments devoted to the manufacture of these groups of wearing apparel amounted to \$2,749,708,697. Of the total value of clothing made men's clothing constituted 32.8%; men's work clothing, 5%, and women's clothing, 62.2%.

MEN'S CLOTHING MANUFACTURE, U.S., 1923-29

Year	No. Establishments	Wage Earners	Wages \$	Value of Products \$
1923 ..	4,024	158,173	207,252,217	1,016,721,705
1925 ..	3,491	141,511	179,044,721	946,274,140
1927 ..	3,562	146,099	184,613,090	932,181,718
1929 ...	3,691	149,868	179,768,808	901,104,205

For the year 1929 85.2% of the total output was made in seven leading states: New York 42.1%, Illinois 13.1%, Pennsylvania 10.9%, Ohio 7.6%, Mary-

CLOTHING MANUFACTURE



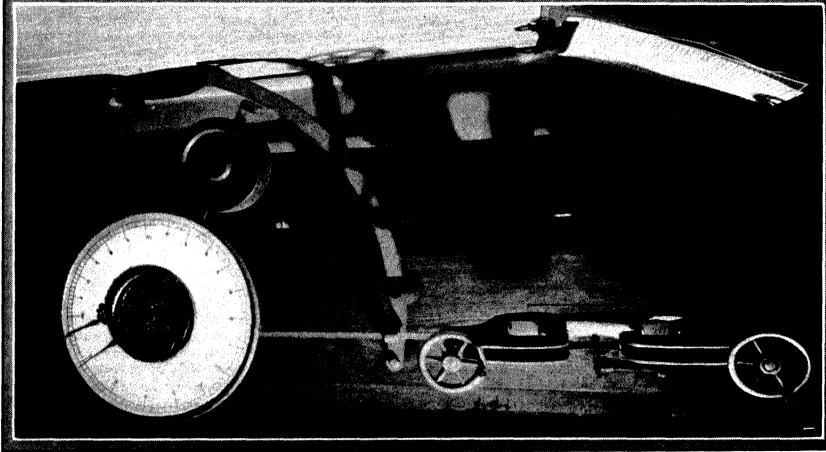
COURTESY HART SHAFNER & MARK, CHICAGO

STEPS IN THE MANUFACTURE OF CLOTHING

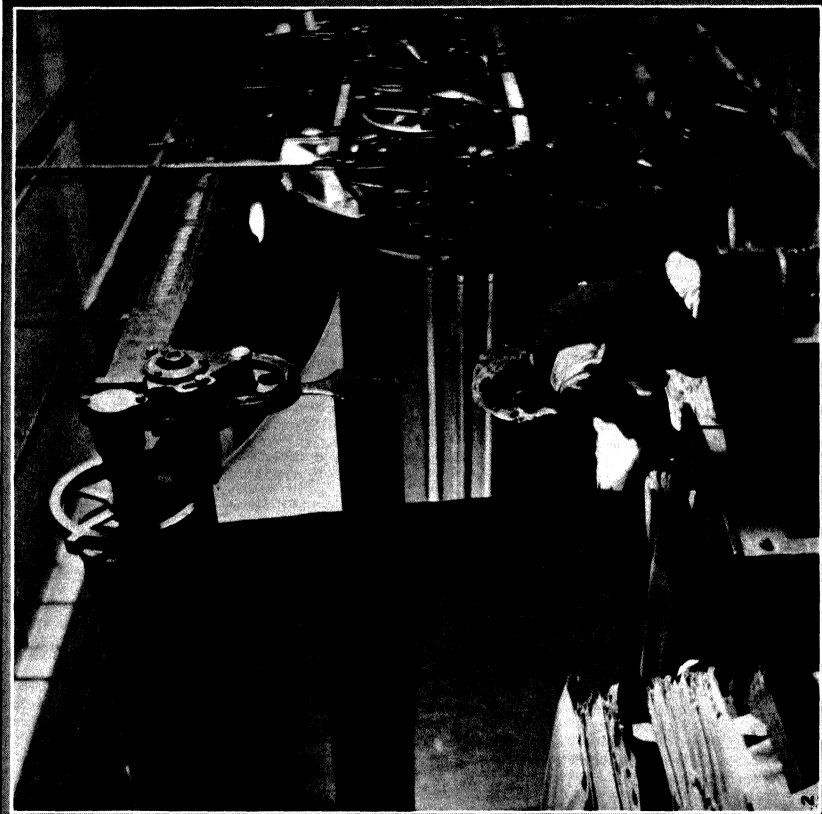
1. The thread count. Each piece of cloth is tested for the uniform number of "picks and ends" per square inch.
2. Stitching (felling) inner lining at shoulder and arm hole.

3. Fabrics are given the acid test for all-wool and subjected to commercial cleaning fluids. 4. Shaping the collar by using modeling form.

CLOTHING MANUFACTURE

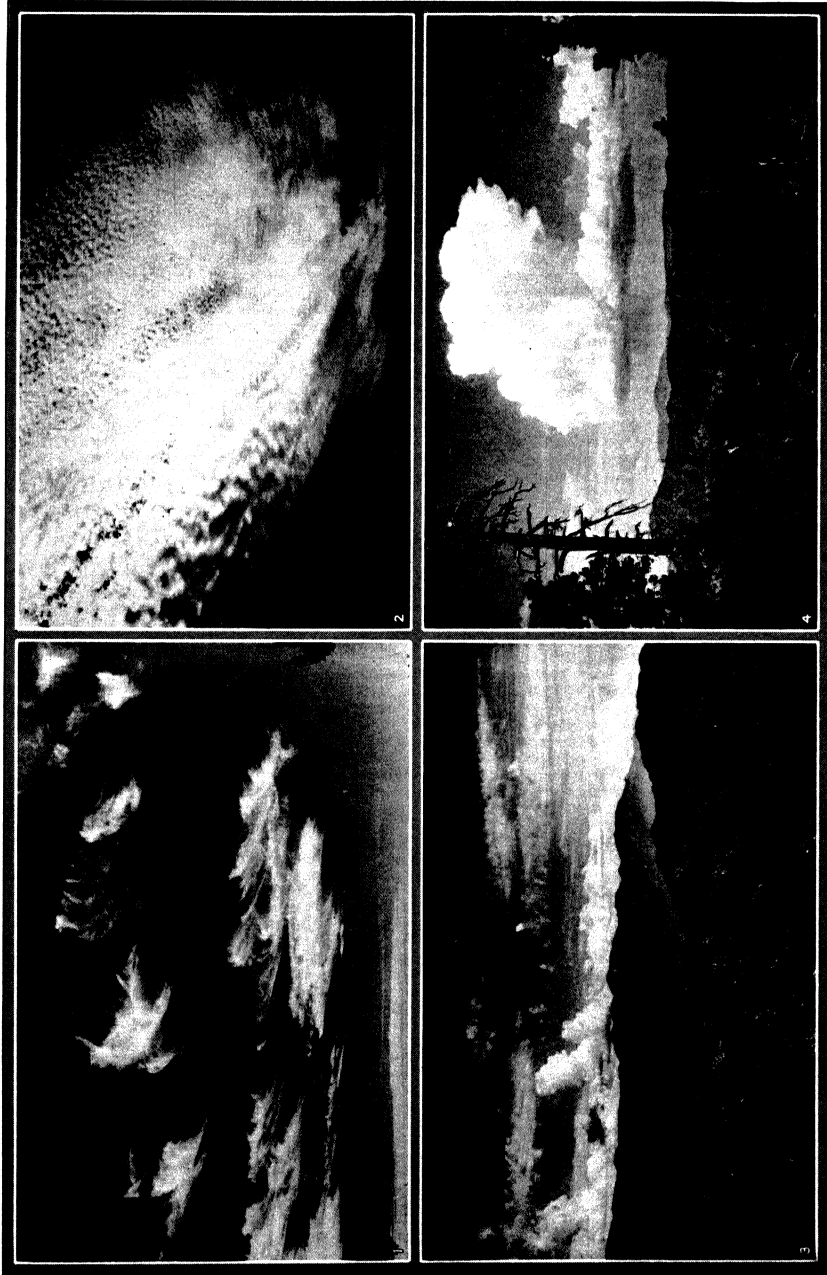


1. Tensile strength machine, telling to a fraction how much "pull" an ounce of fabric will stand without tearing.



2. Machine for pre-shrinking. The fabric is wound on a roller perforated with holes, through which steam passes.

CLOUD



1, 3, 4, PHOTOS BY P. ELLENMAN; 2, PHOTO FROM OBSERVATORY OF THE ERO

CLOUD FORMATIONS

1. Cirrus clouds, consisting of tiny ice crystals. This cloud is always fibrous and takes many forms. 2. Cirro-cumulus, or "mackerel sky," the sailor's danger signal. 3. Alto-cumulus castellatus, small clouds with turret-like projections. 4. Cumulo-nimbus, a thundercloud. Rain is falling from the middle of it.

land 5.0%, Massachusetts 3.4%, and New Jersey 3.1%.

MEN'S WORK CLOTHING MANUFACTURE, U.S., 1923-29

Year	No. Establishments	Wage Earners	Wages \$	Value of Products \$
1923	583	36,647	28,234,741	161,993,026
1925	509	32,821	24,802,629	140,963,602
1927	556	40,612	29,945,915	147,289,025
1929	511	38,201	26,647,078	138,450,078

The women's clothing industry comprises establishments engaged principally in the production of women's, girls', and children's clothing (except that made in knitting mills), as suits, dresses, skirts, jackets, shirt waists and underwear. Manufactures of corsets, millinery, gloves, footwear and hosiery are not included.

WOMEN'S CLOTHING MANUFACTURES, U.S., 1923-29

Year	No. Establishments	Wage Earners	Wages \$	Value of Products \$
1923	7,046	133,195	176,445,518	1,406,683,835
1925	6,127	126,466	175,044,511	1,293,705,291
1927	7,588	154,459	211,349,759	1,494,401,044
1929	8,082	187,500	243,851,143	1,709,580,505

In 1929 96.6% of the total output of women's clothing was made in nine leading states as follows: New York 76.5%, Illinois 4.4%, Pennsylvania 4.3%, Massachusetts 2.5%, California 2.3%, Ohio 2.3%, Missouri 1.8%, New Jersey 1.5% and Maryland 1%.

The clothing industry is centered chiefly in New York City, which produces three-fourths of the women's clothing and more than one-third of the men's clothing made in the United States.

CLOTHING MANUFACTURE from about 1890 has passed almost entirely from the hands of merchant tailors, who worked from measurements taken from individual customers, to the mass-production manufacturer who makes garments from measurements averaged from many people, requiring small changes or "busheling" to make them fit a particular individual. These manufacturers use high-speed machinery and extensive division of labor, as well as large-scale buying of material to produce clothing at a moderate cost and of fair quality. While best designers are secured, the quality of the modern ready-to-wear clothing is not as high as the best of the old-fashioned, hand-tailored work and very seldom is pure virgin wool employed.

The modern clothing manufacturer indulges in extensive advertising as well as the most modern methods of merchandising, frequently establishing branch stores that handle his product exclusively. A growing trade is carried on by mail-order clothing houses, the customer himself supplying the measurements upon which the necessary busheling is done at the factory. In the best of these factories, the highest engineering skill is employed, and all of the advantages of **SCIENTIFIC MANAGEMENT** are utilized.

Standard models are designed for the various sizes, and then disassembled and the pieces arranged so as

to utilize most fully the materials that are to be employed. The pattern is then transferred to a pile of as many as fifty layers of cloth and cut out by means of a circular saw designed for this purpose, though most frequently a special band saw is used. The various pieces are then sent to the fabricating department where they are sewed together into complete suits, as in the older custom tailoring process, though the skill employed in the modern clothing factory need not be so high, and there is much less hand work called for. High speed sewing machines as well as special machines for button holing and hemming, are used.

M. Sc.

CLOTHO, in mythology, one of the three **FATES**.

CLOUD, CHARLES H. (1879-), American educator and clergyman, was born in Cincinnati, O., Feb. 20, 1879. He studied at St. Xavier College, St. Louis University and Creighton University and joined the Society of Jesus (Jesuits), at Florissant, Mo., in 1897. In 1912 he was ordained a Roman Catholic priest. After 1904 he was associated with St. Louis University and served as professor of physics from 1904-09, professor of ethics from 1915-18 and regent of the schools of medicine and dentistry from 1918-24, and became president in 1924.

CLOUD, a large mass of very small drops of liquid water or ice needles, floating in the atmosphere of the earth. Clouds are classified into three broad divisions: the cirrus, a feathery cloud of great altitude; the stratus, or layer cloud, and the cumulus, a solidly packed dome-shaped cloud of comparatively low altitude. According to their more detailed appearance, and their height above the surface ten distinct types are now recognized, arranged in some four or five groups.

The cirrus proper usually consists of a delicately designed, feathery wispy; the cirro-stratus, as the name indicates, is more stratified, and forms a thin veil, often covering the entire sky with a "high haze" which produces **HALOS**. Both are composed of ice crystals and are some 5 to 6 miles high. At altitudes ranging from 2 to 4 miles are found the cirro-cumulus, alto-cumulus and alto-stratus clouds, the first mentioned in the form of flakes, the "mackerel sky"; the second in much larger spherical masses, generally white, and often packed near the centre of the group. The alto-stratus clouds appear as thick layers of heavy dull grayish material, at a height of 1 to 2 miles. Below these float the strato-cumulus and the nimbus proper, the former enormous in extent, gray in color, and sometimes covering the whole sky, especially in winter; the latter heavy, dark-gray, ominous looking masses. They are the typical rain and snow clouds. As soon as precipitation begins the edges take on a frayed appearance, and when the cloud becomes entirely broken up it is termed **fracto-nimbus**.

The ordinary cumulus lies at one mile, a heavy solidly packed cloud, generally with a flat bottom and a dome-shaped top, intensely white, sometimes with beautifully colored edges at sunset and with heavy shadow effects; it is also called **cauliflower**

cloud. The cumulo-nimbus, or typical thunder cloud, is a towering vertical structure with cloud stacked upon cloud, which reaches from 4,000 feet to sometimes more than 20,000. At the top it often has a cirrus-like haze, while at the bottom it is formed into a nimbus; snow, hail or rain falls from it. Cumulus clouds are rarely seen at sunrise, but generally appear during the late morning and all during the afternoon, after the heat of the sun's rays has sent up the moisture from the ground into the air where it condenses into clouds. The lowest type of cloud is the stratus, no more than a high fog, a more or less uniform layer of cloud, not lying on the ground, but not more than 2,000 to 3,000 feet high.

It is estimated that at any one time about half the surface of the earth is covered with clouds of some form or other, the average cloudiness in the tropics being slightly less, that in the temperate zone slightly more than 50%. W. J. L.

CLOUDBERRY (*Rubus Chamemorus*), a dwarf species of raspberry native to the northern parts of Europe, Asia and North America, occurring but sparingly in the United States. It grows from 3 to 10 in. high, from a creeping rootstock and bears somewhat kidney-shaped, slightly five-lobed leaves, large white solitary flowers and orange-yellow, juicy, edible berries. The tall blackberry (*R. argutus*) is also called cloudberry.

CLOUDBURST, the popular name for an extremely heavy, localized rainfall of short duration. Although no sharp distinction can be made between a cloudburst and a heavy shower, the term is usually applied only when the precipitation is a matter of inches in only a few minutes. Their occurrence is due to violent whirlwinds which carry the hot and moist air above the ground up to tremendous heights, the vertical force of the wind being great enough to prevent the condensed waterdrops from falling until long after they are formed. When finally the upward current of air is broken, the amount of water collected may be so large that it falls nearly as a solid sheet, and a cloudburst will result. From this explanation it follows that they are likely to occur in hot regions, even when these are comparatively arid.

CLOUGH, ANNE JEMIMA (1820-92), English educator, was born at Liverpool, Jan. 20, 1820. She opened a school in 1841, which she kept for five years. Then she studied in London, taught for several years, and opened another school in Westmoreland. She was prominent in promoting the education of women and helped to found, serving as secretary, and later as president, the North of England council for the higher education of women. Miss Clough was the first principal of Newnham College. She died Feb. 27, 1892.

CLOUGH, ARTHUR HUGH (1819-61), English poet, was born at Liverpool, Jan. 1, 1819. He was educated at Rugby, under Dr. Arnold, and at Oxford, where he remained until 1848, having gained a fellowship at Oriel College. After a trip abroad he became principal of University Hall, Union College,

London, and then visited the United States. Returning to London he became Examiner in the Education Office, and from that time on combined official activities with his literary career. Clough reflected the ethical spirit of his times, and on him was written Matthew Arnold's superb elegy *Thyrsis*. His principal work was the revision of Dryden's translation of Plutarch; other publications include *Amours de Voyage*, *Mari Magno* and a number of lyrics and elegiac writings. He died in Florence, Italy, Nov. 13, 1861.

CLOVE OIL, obtained from distillation of the clove, is a pale yellow liquid, freely soluble in alcohol, nearly insoluble in water. Oil of clove is an antiseptic and because of its aromatic qualities it is used as a flavoring agent. Externally it is a counter-irritant. In dental practice it is often used to relieve "toothache," particularly when mixed with an equal amount of chloroform.

CLOVER (*Trifolium*), an important group (genus) of annual and perennial herbs of the pea family. There are nearly 300 species native to temperate regions, of which over 60 are found in the United States, chiefly west of the Rocky Mountains. They bear leaves composed of three leaflets and small flowers in dense heads or spikes. To the clovers belong several of the most valuable hay and fodder plants. Red clover (*T. pratense*), native to Europe and thoroughly naturalized in North America, is the most important leguminous hay and pasture plant of the eastern states. Other important clovers are the Alsike or Swedish clover (*T. hybridum*), native to Europe and widely grown in the United States for hay and pasture; the white clover or shamrock (*T. repens*), native to both Europe and North America and used in lawns and pastures; the Italian or crimson clover (*T. incarnatum*) of Europe, a very ornamental plant grown as a catch- or cover-crop in orchards; and the Egyptian clover (*T. alexandrinum*), native to Egypt and Syria. The clovers possess the power to enrich the soil, through bacterial colonies on their roots, by fixing nitrogen from the air; they are also valuable as green manures to be plowed under.



RED CLOVER

Many plants closely related to the clover groups are also called clover; among these are sweet clover (*Melilotus*), bur clover (*Medicago*), bird's-foot clover (*Lotus*) and prairie-clover (*Petalostemon*).

CLOVER HULLERS, machines usually comprising a stemming and hulling cylinder, the stemming cylinder removing the pods and breaking up the plants and the hulling cylinder rubbing the seed out. A grain thresher may be used when equipped with corrugated teeth and other special attachments. See also **THRESHERS**.

CLOVE-TREE (*Eugenia aromatica*), a handsome aromatic tree of the MYRTLE family, sometimes 30 ft. high, bearing oblong evergreen leaves and minute pale purple flowers. It is native to the Molucca islands and is widely cultivated in the tropics for its flower buds which, when dried in the sun, furnish the cloves of commerce. The oil of cloves, used in medicine and in scenting soaps, is obtained by distilling cloves in water.

CLOVIS I (c. 466-511), founder of the kingdom of the Franks, was born about 466. His father, Childeric, was king of the Salian Franks and when Childeric died in 481, Clovis ruled over his realm as a small king in what is now Belgium. He succeeded before the end of his reign in extending his domains until they touched the Pyrenees and the Alps. With a heavy hand he put down internal disaffection and ably pushed his conquests abroad. In 486, at the head of a few thousand Frankish warriors, he overcame the Roman general Syagrius near Soissons, and thus extended his rule to the Loire. Ten years later he defeated the Alamanni, whose conquest led to his conversion to orthodox Christianity. This alliance with the Bishop of Rome Clovis now turned to account by proceeding against the Arian Visigoths in Aquitaine. At the battle of Vouillé in 507, he defeated them and extended his southern frontier to the Pyrenees. Before his death in 511 Clovis had started the conquest of Burgundy, a conquest to be completed by his sons.

CLOVIS, a city near the eastern boundary of New Mexico, the county seat of Curry Co., situated 95 mi. northeast of Roswell. It is served by airplanes, buses and the Santa Fe Railroad. Clovis lies in an agricultural region on a high plateau. It is a shipping center for grain, fruit and live stock, and has flour mills, railroad shops and an aviation supply factory. The city was founded by the Santa Fe Railroad in 1906 and incorporated in 1908. It is located on the old cattle trails leading to Dodge City, Kan. Easily accessible by highway are the Carlsbad Caverns, in southeastern New Mexico, Lincoln National Forest and Quivira Monument in the central part of the state. Pop. 1920, 4,994; 1930, 8,027.

CLUB-FOOT, a deformity of the foot in which it is twisted out of shape or position. It may be congenital or acquired. In congenital form it is usually characterized by a short heel tendon, toe-drop with the toes swung inward assuming the position of "pigeon toes."

Club-foot may be hereditary and may affect more than one member of a family. It is most common in the first born child. It may affect one of twins and one or both limbs of the same child.

Club-foot may also be acquired and is usually due to infantile paralysis, to spastic paralysis injury or to infection.

The treatment may be divided into the immediate and the remote. The immediate treatment should be carried out as soon as the child is born. It consists of gentle stretching and manipulation followed by reten-

tion of the foot in the corrected position, either in an adhesive strapping which should be changed every four or five days, or a plaster-of-Paris cast changed once in from seven to ten days. If these cases are not treated early, operation may be necessary. Operations consist in manipulation under anesthetic, and cutting operations, which are performed upon the ligaments, tendons, and, infrequently, upon the bones. After operation, a plaster-of-Paris cast is necessary. P. L.

CLUB MOSS, a group of small, evergreen, often extensively creeping plants, closely allied to the ferns.

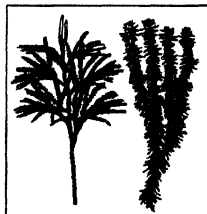
There are about 100 species, widely distributed throughout the world, about 15 occurring in the United States. See also LYCOPodium.

CLUB ROOT. See PLANT DISEASES; SLIME MOLD.

CLUBS, POLITICAL, in England during the 19th century, the great London clubs such as the Carlton (Conservative, 1831) and the National Liberal, have had a most important influence in party affairs. In them the parliamentary and provincial leaders of the upper class are brought together in close association. After the extension of the suffrage in 1867, workingmen's clubs were established all over the country, these offering social advantages at very small cost and serving the purposes of party propaganda. They differ from the ward club of New York or Chicago, for they concern themselves with national rather than local machine politics and have a larger membership. No American club plays a rôle like that of the Carlton in national politics.

CLUJ, formerly Klausenburg, a city of Rumania, capital of the district of Cluj, in Transylvania. It is surrounded by wooded eminences. On the square, lined with houses of the old noble families, rises the Gothic Cathedral St. Michael, 1396-1432; other churches are in the city. Besides the university, there are many schools and the national museum which is located in the Botanical Garden, also a library and buildings of scientific societies. It is the seat of a Greek Oriental and a Reformed bishop. There are agricultural industries, machine and tobacco factories, with trade in farm products. Of the inhabitants 45% are Rumanians, 30% Hungarians. Pop. 1930, 98,550.

CLUNIACS, members of the monastic order that derived its name from the monastery of Cluny in eastern central France, founded in 910 A.D. Cluny became the center of a monastic reform that affected not only monasticism but the life of the Latin Church to such an extent that from the middle of the 10th century to the middle of the 12th it was the chief religious force in Western Christendom. Cluniac monks followed the Benedictine Rule, with some changes, but their organization was the antithesis of the Benedictine principle of autonomy. Every



CLUB MOSS, OR RUNNING PINE

and are there preserved from complete decay. If the sinking is not too rapid the growth of new material can keep pace with it, and thus great thicknesses accumulate. This is peat. The older peat at the bottom is compressed by that later deposited, and becomes a woody to jelly-like mass brown to black in color, in which the vegetable structure is indistinct,



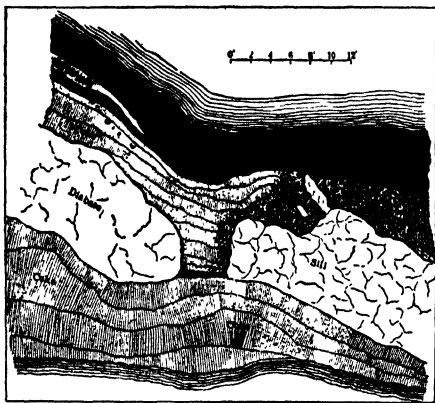
FROM E. S. MOORE. COAL. JOHN WILEY & SONS

PEAT FORMING IN A BOG

Large trees gradually grow out over the peat deposit

but which may contain 80% to 90% of moisture. About a foot of this material accumulates in a century. Approximately five feet of it will form a foot of BITUMINOUS COAL, which in turn will produce a half a foot of ANTHRACITE.

When the bog or swamp sinks definitely below the water-level, sedimentary rocks like SHALE and SANDSTONE are deposited over the peat. The further compression produced by their weight brings about the transformation of peat to LIGNITE. These two forms are also called BROWN COAL, because of their color.



FROM E. S. MOORE. COAL. JOHN WILEY & SONS

INTRUSION OF IGNEOUS ROCK (DIABASE SILL) INTO A COAL SEAM, PRODUCING NATURAL COKE

Increased density and loss of moisture characterize this change, and the subsequent ones which result from the continued pressure. The products, in order, are black lignite, or subbituminous coal, which has a black, pitch-like luster; bituminous coal, which breaks into cubical pieces and is black to dark gray in color; semi-bituminous and semi-anthracite; and anthracite. The latter is brilliant black, hard, and will not soil the fingers, as do the other forms.

The evolution of peat through bituminous coal can be produced by burial beneath a heavy load of sediments, especially if continued for long geological ages. Intrusion of coal beds by molten, IGNEOUS Rocks will effect a further local transformation of bituminous to anthracite, or even to carbonite, a natural COKE. The normal mode of producing anthracite, however, is through the great heats and pressures generated in the course of crustal movements which crumple and fold the rocks involved. If the overlying rocks are sufficiently porous or cracked to permit the escape of the gases generated in the process, the change from bituminous coal to anthracite is effected.

The progressive change from lignite, at one end, to anthracite at the other, is accompanied by loss of moisture and volatile matter. The volatile material consists of gaseous hydrocarbons, arbitrarily defined as that part of the coal which can be driven off at 100 degrees centigrade, in the absence of oxygen. The fixed carbon is the remaining carbon. Together with the ash, the mineral matter present in the original plants or as silt in the bog, this fixed carbon remains constant in amount, but increases in relative proportions. Thus, lignite may contain 40% moisture, 29% volatile matter and 31% fixed carbon, ash being ignored. Bituminous coal may have 6% moisture, 41% volatile, and 53% fixed carbon. The volatile matter is proportionately higher only because of the sharp decrease in moisture; absolutely, it is less. For anthracite, the figures are 3% moisture, 3% volatile and 94% fixed carbon. The ash usually runs about 10%. The ratio of fixed carbon to volatile matter is called the fuel ratio, and is used for purposes of classifying coals.

The heating power of coal is measured in BRITISH THERMAL UNITS. Peat has a calorific, or heating value, of about 3,000 B.t.u. per pound, lignite of 7,000 B.t.u., bituminous coal of roughly 14,000 B.t.u., and anthracite of between 13,000 and 14,000 B.t.u. per pound.

Geological and Geographical Distribution.

Since the higher stages in coalification are brought about by heavy pressure, it would be expected that the better coals would be found in those older sediments which had been most heavily covered by later material. In the main this is true, and the better bituminous and anthracite coals occur mostly in the oldest and most prolific coal-bearing beds, those of the CARBONIFEROUS PERIOD. Coal has been abundantly formed, however, from the middle DEVONIAN down to the present time. That recently formed is still peat. Next to the Carboniferous, the CRETACEOUS was the most important coal-forming era, and great quantities of coal in western North America are of this age. The most valuable coals of America, England, Europe and China are, however, of Carboniferous age.

The coal reserves of the world have been estimated with considerable accuracy, and it appears that about half these reserves are in the North American continent, principally within the United States, although Canada has lesser amounts. Asia contains about a

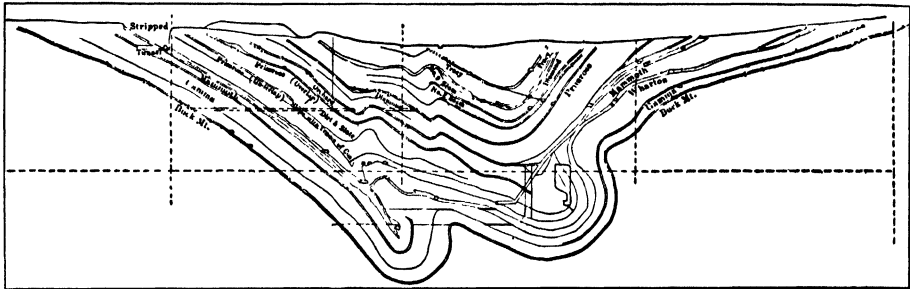
fourth of these reserves, mostly concentrated in China, with smaller reserves in India. Europe has only a sixth of the world total, chiefly in England and Germany. Australasia and South America together contain less than a tenth. Altogether, the world reserves amounted in 1931 to about 7,000,000,000 metric tons.

Production. "Mineral Coal" is first mentioned in literature in the 4th century B.C., but it was not then extensively used. The "coal" in those days meant charcoal, mineral coal being the term used to designate coal. "Mineral coal" was considered so objectionable as recently as the 17th century that many European cities had regulations against its use. The invention of the steam engine, however, gave great impetus to the use of this fuel. In America the first bituminous coal was mined in 1787, and anthracite about 1805, although both had been discovered much earlier.

The estimated production for 1930 was 65,000,000 metric tons.

Anthracite production in the United States is lessening in favor of bituminous, but the production of both is slowing up because of the increasing use of other sources of energy, such as oil, gas and water. Lignite and semi-bituminous coal are coming into greater use, especially in Germany.

Uses. Anthracite is especially in demand for domestic fuel, although some bituminous coals are also used. This takes about 20% of domestic production. Approximately 25% goes into locomotives and steamships, which use all types, the latter preferring highest heat yield per bulk. Low price per heat unit and dependability of supply are the requirements for steam and power generation, which takes all types, consuming about 34% of the domestic output. Bituminous coals only are used for coke and steel-making,



FROM E. S. MOORE COAL JOHN WILEY & SONS

SECTION THROUGH THE COMPLICATED STRUCTURE OF THE ANTHRACITE FIELD AT HAZLETON, PENNSYLVANIA
Note the naming and numbering of the coal seams

In 1931 the coal resources of the world were being exploited at the rate of more than 1,000,000,000 tons per year, the United States being the largest single producer and contributing a third of the total production. In 1900 the world production was 765,000,000 metric tons, of which the United States produced 32%. By 1915 the total output had risen to 1,193,000,000 metric tons, of which the United States produced 40%. In 1930 estimates placed the world production at 1,410,000,000 metric tons, of which the United States produced about 30%. Prior to 1899 the United Kingdom had led in production, but in that year the United States produced 228,000,000 metric tons to 223,000,000 tons in the United Kingdom. Since then the United Kingdom has held second place, a position which was in 1931 being disputed by Germany.

Anthracite coal comes from regions which have suffered a certain amount of crustal deformation, such as in the Appalachian region of eastern Pennsylvania, and in Wales. These are practically the only anthracite producers. In 1900 about 50,000,000 metric tons of anthracite came from the United States. The peak of anthracite production was in the period 1915-20, amounting to 80,000,000 metric tons in the latter year.

because only certain kinds of bituminous coal show the property of agglutinating and making coke when heated. They are essential in steel-making, and therefore in modern industry. Fields yielding this type of coal are rare, and therefore of vital concern in international, as well as national, plans and relationships. This outlet consumes about 15% of domestic coal.

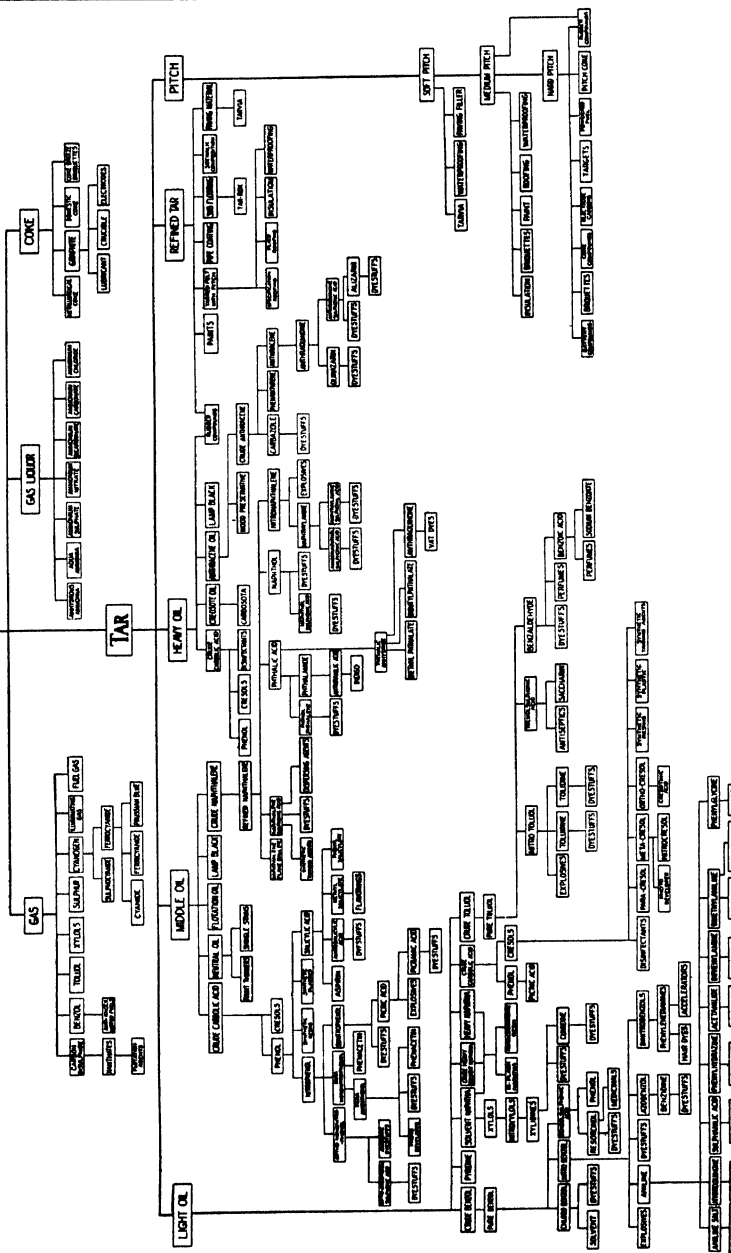
Prior to the World War, coke was chiefly made in beehive ovens, which wasted the by-products. Since then the by-product oven has almost completely displaced the beehive and, besides coke, yields illuminating gas and a host of chemicals, derivatives of the coal tar produced in the course of making coke. See also GEOLOGY; JET; COAL BY-PRODUCTS. S. F. K.

Fuel Value of Coal. Coal holds first place among fuels for furnishing the heating and power needs of the United States. In 1929, bituminous coal developed 53% and anthracite 8% of the total national energy requirements. A total of 654,494 miners, averaging 221 working days during that year, produced 4.21 tons per man-day, or 591 million net tons of coal. Petroleum, supplying 25% of the total energy, ranks next to coal as a fuel.

Coal is composed of carbon, ash and small amounts of hydrogen, oxygen, nitrogen and sulphur. (See

PRODUCTS DERIVED FROM COAL

COAL



MINING, COAL.) All coals contain more or less moisture. The carbon is burned on complete combustion, to carbon dioxide, generating 14,600 BRITISH THERMAL UNITS per lb. of carbon if the air supply is deficient, it is burned to carbon monoxide generating but 4,450 B.t.u. per lb. The volatile hydrocarbons distill off as gases and burn to carbon dioxide if the air supply is ample and temperature above the ignition point. If the air supply is deficient, fine particles of carbon will be freed, which, floating in the combustion gases, constitute smoke or soot.

As compared with other fuels, coal has produced the highest furnace efficiencies of any commonly used fuel. The present record is approximately 92%. Due to carelessness in firing or inadequacy of equipment, average efficiencies approximate 60% in industrial power plants and about 40% in domestic furnaces.

H. W. B.

BIBLIOGRAPHY—Elwood S. Moore, *Coal*, 1922; E. C. Jeffery, *Coal and Civilization*, 1925; W. T. Thom, *Petroleum and Coal, the Keys to the Future*, 1929; R. F. Bacon and W. A. Hamor, *American Fuels*, 1922.

COAL, COKING, a bituminous coal suitable for the production of COKE. Coke cannot be made from all bituminous coals, a type being required which softens and runs together into a pasty mass at the temperature of incipient decomposition. Coking coals will usually stick to the sides of an agate mortar when ground up in it, and usually have a ratio of hydrogen to oxygen exceeding 58. They ordinarily contain over 30% volatile matter. *See also* COAL.

COAL, SMITHING, coal used in metal-working forges, usually a medium low-volatile COAL. It should "coke" well and be low in sulphur and "ash."

COAL ANALYSIS. *See* FUEL ANALYSIS.

COAL AUGER, a tool used in coal mining to bore blasting holes. The boring part comprises a flat steel piece twisted into a screw-like form; the handle has a throw for rotating the tool and a rest which is placed against the body. *See also* DRILLING.

COAL BY-PRODUCTS, the by-products of the CARBONIZATION of coal, and similar materials, are, principally GAS, TAR, LIGHT OIL, and AMMONIA. The average yields per ton of coal are: gas, 10,000 to 12,500 cubic feet; tar, 8 to 12 gallons; light oil, 2.5 to 3.5 gallons; and ammonium sulphate (*see* AMMONIUM COMPOUNDS), 20 to 27 pounds. The average total heating value of debenzolized coke-oven gas is from 540 to 570 B.t.u. per cu. ft. and a typical analysis is: Carbon dioxide, 2.2%; illuminants, 3.5%; oxygen, 0.3%; carbon monoxide, 6.8%; hydrogen, 47.3%; methane, 33.9%; nitrogen, 6.0 per cent.

Except when the gas is distributed as town gas, the light oils are recovered by "scrubbing" the gas with a petroleum distillate oil, from which they are removed by steam distillation. The crude light oil, after refining, is blended with gasoline in the production of anti-knock motor fuels (*see also* ANTI-KNOCK COMPOUND), or is separated by fractional distillation into pure benzol, toluol, and solvent naphtha, which are used in the chemical industries as solvents and source

materials for DYES, resin plastics (*see also* PLASTICS, SYNTHETIC), EXPLOSIVES, etc.

Ammonia, an important FERTILIZER ingredient, is usually recovered as ammonium sulphate by bubbling the gas through concentrated sulphuric acid. It is also found in the aqueous liquors from the condensers, from which it is distilled after adding lime to free the fixed ammonia from its salts (*see also* TAR; COAL TAR). Minor by-products obtained in the purification of coal gas are cyanogen compounds and sulphur in a very finely divided or colloidal state (*see* COLLOIDS AND THE COLLOIDAL STATE), especially adapted to use as a fungicide. *See also* CARBONIZATION. A. C. F.

BIBLIOGRAPHY.—Horace C. Porter, *Coal Carbonization*, 1924.

COALDALE, a coal mining community, a borough in Schuylkill Co., in eastern Pennsylvania, situated 17 mi. northeast of Pottsville; it is served by two railroads. Anthracite is the chief product of Coaldale. There also are shirt and hosiery factories. Pop. 1920, 6,336; 1930, 6,921.

COAL GAS. *See* GAS, MANUFACTURE.

COALITION, a combination, usually temporary, of states for purposes of joint action, to realize a common or mutual end. It is not so formal or so binding as an alliance, and its objects may but need not be as matured as those of an alliance. Coalition is also a union of opposing or divers political parties in the Cabinet of a government for the purpose of working together for common parliamentary objectives. *See* COALITION MINISTRY.

COALITION MINISTRY. In a Parliamentary Government the executive is in effect a committee of the legislature; the ministry—or, rather, the cabinet—is composed of members of Parliament, responsible to Parliament and retaining office only so long as they have its support. When there are but two parties of appreciable importance, as has generally been the case in Great Britain, the ministry is made up of members of the majority party. A coalition ministry is an exception, due either to the fact that no one party commands a majority or to some emergency because of which partisan differences are disregarded. In France and some other continental countries where there are a number of political parties, every ministry is in some sense a coalition, though not so termed.

Coalition ministries in the reign of George III were coalitions of factions rather than of parties. In the middle of the 19th century the balance of power was held for a time by the Peelites, who had seceded from the Tory party, and the Aberdeen ministry, 1852-55, was a Whig-Peelite coalition. During the World War a coalition government was formed by the admission of Conservatives to the cabinet in May 1915. When Lloyd George became Prime Minister, Dec. 1916, a constitutional reorganization took place with the formation of a small war cabinet; the Lloyd George coalition of 1918-22 was largely Conservative. In the summer of 1931 an emergency coalition was formed in the face of the threatened collapse of

the British economic structure. This involved the virtual suspension of the constitution because an immediate election seemed inadvisable. The elections two months later, returned the coalition to office with a majority composed in the main of Conservative members.

A. H. S.

COAL MINING. See MINING, COAL.

COALSACK, a region immediately to the east of the constellation Crux, where faint stars are obscured by a dark cloud, and which therefore appears black against the luminous background of the MILKY WAY.

COAL TAR, a nearly black semi-solid, *pix carbonis*, obtained from the destructive distillation of coal, having a characteristic naphtha odor and a sharp bituminous burning taste; only slightly soluble in water, partly dissolved by alcohol. It is by far the most important of the tars and, next to gas and coke, the most important product from the CARBONIZATION of coal. Approximately one-half of the 600 million gallons produced annually in the United States is used as a fuel in manufacturing steel. The remainder is distilled and converted into crude and refined coal-tar products, many of which serve as raw materials for a long list of organic chemicals used in the production of solvents, dyes, explosives, tear gases (see CHEMICAL WARFARE), pharmaceuticals, photographic developers, perfumes, synthetic plastics, and the like. However, the partly refined and crude coal-tar products are consumed in quantities many times greater than all the pure products combined. Partly refined tar is used as protective paint, for surfacing roads, binding road materials, and for saturating paper and felt for building construction.

CREOSOTE oil, an important coal tar product, is used for the preparation of DISINFECTANTS, sheep dips, and TIMBER PRESERVATION; likewise large quantities of PHENOL and CRESOL are used in the manufacture of synthetic plastics. Crude tar acids are used as froth producers in ore FLOTATION.

Medicinally, because of its antiseptic and non-irritant action in the skin, coal tar is used in ointments or lotions in the treatment of skin diseases. However, *pine tar* finds a greater use in medicine than does coal tar. See also COAL BY-PRODUCTS; TAR.

BIBLIOGRAPHY—Horace C. Porter, *Coal Carbonization*, 1924; A. R. Warnes, *Coal Tar Distillation*, London, 1923.

COAL TAR DYESTUFFS. See DYES, SYNTHETIC.

COAL TESTING. See CALORIMETRY; BOMB CALORIMETER; MATERIALS TESTING; FUEL ANALYSIS.

COAMINGS, sides of a hatch opening in the deck of a vessel. In a steel vessel the coamings are plates, extending around the hatch opening and connected to the deck by angle irons. Rules pertaining to the height and structural details of coamings for steel ships come under the jurisdiction of the classification societies.

BIBLIOGRAPHY—American Bureau of Shipping Rules; Lloyd's Rules.

COAST, the seaward margin of the land. Continental coastlines are continually changing under the

destructive attack of waves and the constructive, straightening effect of tides and currents, which build up beaches and bars. They are also profoundly modified by the rise or subsidence of the land. A recently uplifted coast is regular, with few good harbors, like that of California. A drowned coast is deeply indented and fringed with islands, like that of Maine; a deeply indented fjord coast, as that of Norway, is partly the work of ice. The possession of an irregular coastline favors the development of commerce. Switzerland, Paraguay, Bolivia and Serbia are countries destitute of coasts.

COASTAL PLAIN, a lowland at the foot of a range of mountains sloping gently to the sea. Although the Atlantic coastal plain includes Cape Cod peninsula, Nantucket and Martha's Vineyard, Long Island and all of New Jersey southeast of a line from New York Bay to Trenton, yet in area and importance the coastal plain of the United States is almost entirely a southern physiographic province, bordering the South Atlantic and Gulf coasts from Delaware Bay to the Rio Grande. The present lowland area is only 30 to 50 mi. broad in New Jersey, but increases in width southward to Georgia and Florida. In North Carolina, it is 200 mi. wide, and in eastern Texas more than 300. Its total area is about 365,000 sq. mi. In their lower courses the rivers of the coastal plain are aggrading streams, building up alluvial flood plains and filling the estuaries with bars or deltas. Keeping these channels open for navigation places a heavy financial burden on the Government. This work, however, has given deep navigable harbors and channels for ocean vessels to Baltimore, Norfolk, Wilmington, Charleston, Savannah, Brunswick, Jacksonville, Tampa, Pensacola, Mobile, New Orleans, and Houston.

COAST AND GEODETIC SURVEY, U.S., a body charged with the survey of the coasts of the United States and its possessions and with the publication of navigational charts of those regions. These surveys include base measurements, triangulation and traverse, hydrography and topography and tidal and current observations along those coasts; deep-sea soundings, temperature and current observations along the courses of the Gulf and Japan streams; the survey of rivers to the head of tidewater; magnetic observations and researches; seismological investigations; gravity measurements; and the determination of elevations by trigonometric leveling. It is also charged with the determination of geographic positions by astronomic observations and by triangulation and traverse and with the determination of elevations by spirit leveling, in the interior of the United States and Alaska.

The results of these surveys and investigations are published in the form of navigational charts, coast pilots giving detailed sailing directions, annual tables giving the predicted times and heights of the tide at many ports and the velocities and directions of tidal currents, charts showing the magnetic declination, notices to Mariners, published jointly by the

Coast and Geodetic Survey and the Bureau of Light-houses, and in annual reports and special publications. The bureau compiles and publishes maps of civil airways.

R. E. C.

COAST DEFENSE, in general terms, the utilization of the Army and Navy to prevent an enemy from securing a foothold on any portion of United States territory. Specifically, coast defense prevents bombardment and bombing of the United States seacoast cities and naval centers by raiding squadrons appearing suddenly; it affords the United States' seaborne commerce safe harbors in which vessels may rendezvous when they may not remain abroad on the high seas; it makes it possible for its own naval vessels to outfit, equip and repair or be at ease and in security in time of need; and it will hold off the enemy, in case of attack, until field forces can be mobilized.

The functions of the Army in coast defense are to provide and operate mobile forces for the defense of the coast and to provide, maintain and operate essential harbor defenses. To facilitate the execution of these functions, the frontier is divided into frontier commands, the limits of which are prescribed and troops allotted thereto by the War Department. These frontier commands are further subdivided into sectors and subsectors by the proper commanders and troops are allotted to each subdivision.

Operations against the seacoast of the United States may be divided into two general classes, those not involving landings in force and those which do involve landings in force. The first class includes purely naval attacks, and naval attacks accompanied by air attacks and in some cases by minor landings. Against such attacks, the coast ARTILLERY manning the seacoast fortifications and employing railway and tractor artillery, SUBMARINE MINES and antiaircraft artillery (*see ARTILLERY: Army*), will be charged with making the defense. For the full effectiveness of such a defense, the coast artillery should have the support and the cooperation of aviation and local infantry supports.

The second class of attacks involve the attempted landing of a large body of troops, with powerful naval and air support—at least during the initial landing. Against such an attempt coast artillery alone is inadequate. A mobile force of all arms is required for a successful defense. The coast artillery, manning the heavy, long-range, railway and tractor and anti-aircraft artillery, is an essential component of such a force. Unless it is present, enemy naval vessels and aircraft cannot be taken under fire at a sufficiently great range to prevent the enemy's fire from overwhelming the defenders, with the possibility of landing troops in small boats.

Certain forces of the Navy termed naval coastal forces consisting mainly of patrol vessels, coast defense submarines, mine layers and mine sweepers, DESTROYERS and, possibly, some of the older BATTLESHIPS and CRUISERS not suitable for service with the fleet, have specific coast defense functions. These forces assisted by such aviation as may be available have the

mission of controlling coastal zones and sea lanes, conducting sea operations against any enemy force in the vicinity of the coast, as well as that of supporting the Army in repelling attacks on the coast. S. J.

COAST GUARD, U.S. The Revenue Cutter Service was organized by Act of Congress, Aug. 4, 1790, approved by President George Washington, and remained a separate organization until 1915, when Congress created the Coast Guard by combining the Revenue Cutter Service with the Life Saving Service. In time of war, it automatically becomes a part of the navy. It has an excellent record in all wars of the United States, and in peace time has saved much life and property at sea.

The primary duties of the Coast Guard are: 1. Rendering assistance to vessels in distress and saving life and property. 2. Destruction or removal of wrecks, derelicts, and other floating dangers to navigation. 3. Operating as a part of the Navy in time of war or when the President shall so direct. 4. Extending medical aid to American vessels engaged in deep-sea fisheries. 5. Protection of the customs revenue. 6. Enforcement of law and regulations governing anchorage of vessels in navigable waters. 7. Enforcement of law relating to quarantine and neutrality. 8. Suppression of mutinies on merchant vessels. 9. Enforcement of navigation and other laws governing merchant vessels and motor boats. 10. Enforcement of law to provide for safety of life on navigable waters during regattas and marine parades. 11. Protection of game and the seal and other fisheries in Alaska. 12. Enforcement of sponge-fishing law. 13. International ice patrol in the vicinity of the Grand Banks off Newfoundland.

Its military discipline and training in peace well fit it for its naval duties in wartime. It has done splendid service in Alaskan waters.

It is administered by the Treasury Department, the Assistant Secretary of the Treasury having supervision, and more immediately by the Commandant of the Coast Guard who holds the rank of Rear Admiral.

Its personnel on June 30, 1930, consisted of 365 regulars, 39 temporary commissioned officers, 97 cadets, 868 warrant officers, regular and temporary, and 10,762 enlisted men.

R. E. C.

COAST GUARD ACADEMY, U.S., a national institution for training cadets for commissions in the Coast Guard Service, located at New London, Conn. Entrance examinations are held every June, conducted by Civil Service examiners in practically all of the states. Annual practice cruises are carried out in the summer to provide practical training and instruction. Cadets are graduated as ensigns in the Coast Guard.

In 1931 all commissioned officers in the Coast Guard, excepting constructors and commandants of districts, received appointments after graduation from the Coast Guard Academy, or after they had demonstrated their fitness for service as officers while serving under temporary commission. Owing to the nature of the service performed by the Coast Guard officers,

particularly those at sea, and since 1919, in their prohibition duties (*see* PROHIBITION), the authorities desire as candidates for the Academy only young men possessing a sound body and an iron constitution, suitable preparation, good natural capacity, aptitude for study, industrious habits, perseverance, an obedient and orderly disposition and a correct moral deportment. *See also* COAST GUARD. R. E. C.

COAST RANGES, a series of low mountain ranges bordering the Pacific coast of the United States. In Washington they are represented by the great mass of Olympic Mountains which culminate in Mt. Olympus, 8,200 ft. high. Due to extremely heavy rainfall they are clothed with a luxuriant forest. The Oregon coast range, also well-wooded, begins in Washington just south of the Chehalis River and extends south to the Klamath mass which spread across the Oregon-California line and eastward as far as the Cascades. The California coast ranges, as far south as $34^{\circ} 30'$ N. lat., are characterized by an echelon arrangement by which their northern extremities often extend to the water's edge, interrupting the coastal plain. In southern California the Angeles ranges have a more nearly east-west trend and follow no orderly arrangement. The general height of the series varies from 2,000 to 4,000 ft. in all but the Klamath mountains where some peaks rise to over 9,000 ft.

COATESVILLE, a city of Chester Co., Pa., on Brandywine Creek, 38 mi. west of Philadelphia. It is served by the Pennsylvania and the Reading railroads, motor bus lines and an airport. Coatesville has two important steel plants. Silk is an important manufacture. In 1929 the retail trade amounted to \$6,601,110. The total value of manufactures reaches



COURTESY N. Y. ZOOLOGICAL SOCIETY
COATI

about \$30,000,000 annually. Dairy products, corn, wheat and mushrooms are produced in the surrounding region. The first steel plate in America is said to have been rolled here in 1810. Coatesville became a city in 1915. Pop. 1920, 14,515; 1930, 14,582; about 10% foreign-born.

COATI, a ring-tailed, raccoonlike animal of the genus *Nasua*, ranging from Texas to Paraguay. The

long soft coat varies from brownish-gray to chestnut. The scientific name, meaning "nosey," emphasizes the animal's most distinctive feature. The oddly mobile snout may be turned downward and stiffened, for rooting out grubs and worms, or elevated to free the jaws when iguanas are hunted. Coatis are largely arboreal. In the trees or on the ground, they hunt in packs. They make entertaining, affectionate, and highly acrobatic pets.

COATS LAND. *See* POLAR EXPLORATION.

COBALT, a chemical element (symbol Co, at. wt. 58.94) belonging to the metals and showing much resemblance to nickel and iron. It is highly magnetic, has a specific gravity of from 8.5 to 9, is hard and brittle, melts at 1480°C , and, when pure, is gray-white in appearance, though it tarnishes quickly to a dull-red color. In nature it occurs nearly always in connection with ARSENIC, chiefly as smaltite and cobaltite; its present principal source of supply is the deposit—rich also in silver—in Ontario. In solution, or in water-containing crystals, the cobalt salts are generally pale pink in color, but the dry, anhydrous compounds are usually deep blue, on which is based the use of cobalt chloride as a sympathetic ink. Dry, insoluble cobalt compounds are used as pigments for paints, as laundry blue, in paper manufacturing, in ceramics, etc., the various compounds being known under such names as cobalt blue, turquoise blue, or Thenard's blue. Industrially, it finds extensive application in alloys, with or without iron, while, furthermore, it is of much interest theoretically, through the large class of very complex compounds, cobaltamines, which it forms by interaction with ammonium salts.

COBALT, a town of Ontario, Canada, situated on Cobalt Lake, 330 mi. north of Toronto, in one of the richest silver districts in the world. The discovery of silver ores in the vicinity was made in 1903. These ores contain also cobalt, nickel and arsenic, all of which are recovered in the refineries established in the town and its environs. There are several lumber and planing mills. Pop. 1921, 4,449; 1931, 3,885.

COBÁN, capital of the department of Verapaz, in the republic of GUATEMALA, on the Rio Cajabon, about 85 mi. north of Guatemala City. Cobán is an old town founded soon after the Spanish Conquest and has been prosperous in times past but is not much larger now than it was a century ago. It is in a rich coffee section which furnishes the bulk of the city's commerce. The coffee, known to the trade as Cobán, is of an unusually fine quality. The owners of the plantations are for the most part Germans, and the greater part of the coffee is exported to Germany. It amounts to about 10% of the total exported from the republic, and is shipped from the port of Livingston, with which Cobán is connected, by a short railway and a regular line of launches on Lake Izabal and the Rio Dulce. A large fruit company has established a number of banana plantations near Cobán, and they furnish a continually increasing export. The town has few manufactures, and in recent years has erected modern buildings. Pop. 1928, 30,000.

COBB, HENRY IVES (1859-), American architect, was born at Brookline, Mass., Aug. 19, 1859. His education at the Massachusetts Institute of Technology and Harvard University completed, he moved to Chicago, where in 1893 he was a member of the National Board of Architects for the World's Columbian Exposition. He was special architect for the Federal Government, 1893-1903, and designed a number of government buildings, at Chicago, Annapolis, League Island, etc. He was also architect for the Pennsylvania State Capitol, Harrisburg; the Chicago Opera House, Courthouse and City Hall and the Newberry Library of the University of Chicago; the American University at Washington, and many other important buildings, including the Liberty Tower and Harriman Bank in New York City, where he later settled.

COBB, HOWELL (1815-68), American public official, was born at Cherry Hill, Ga., Sept. 7, 1815. He was a member of a prominent and wealthy cotton-planting family, and after his graduation from the University of Georgia in 1834, he studied law for two years and was admitted to the bar in 1836. In 1837 he was elected the Solicitor General to a Georgia circuit, which office he filled for three years. He was elected to Congress in 1842, serving from 1843 to 1851. Cobb was extremely nationalistic and until the outbreak of the Civil War strongly in favor of the continuance of the Union. He defended the constitutionalism of the annexation of Texas and supported the Polk administration in its Mexican War policy. He urged the extension of the Missouri Compromise line to the Pacific coast, and as Speaker of the House, 1849-51, he favored the measures of the Compromise of 1850. The passage of the Compromise split the Georgia Democrats into two factions. The Union Democrats with the Whigs formed the Union Party which succeeded in electing Cobb Governor of the state for the term 1851-53. He returned to Congress in 1855 and served until 1857 when he was appointed Secretary of the Treasury, 1857-60. After the election of Lincoln, he became one of the leaders of secession, and attained the rank of major-general in the Confederate Army. He resumed his law practice after the war and while on a visit to New York, died suddenly, Oct. 9, 1868.

COBB, IRVIN SHREWSBURY (1876-), American author, was born at Paducah, Ky., June 23, 1876. A newspaper reporter, at seventeen, he contributed to comic weeklies and later worked for the New York *Evening Sun* and the New York *World*. In 1914-15 he was a war correspondent in Europe. His many humorous writings include *Back Home*, *Cobb's Anatomy*, *Roughing It De Luxe*, *New York Through Funny Glasses* and *Live Talks with Dead Ones*.

COBB, TY (RUS) RAYMOND (1886-), baseball player and manager, was born at Royston, Ga., Dec. 18, 1886. His professional career began in 1906 when he was bought by the Detroit Tigers. In 1907 he was champion batter of the American League,

and maintained his batting supremacy for 9 consecutive years, batting over .300 for 21 consecutive years. His batting average between 1906 and 1926 was .3686, a major league record. For 15 years Cobb was the most spectacular base runner in the game, and celebrated for his "fall-away" slide to bases. In 1911 he was voted the most valuable player in the American League. In the season of 1915 he stole 96 bases. He was appointed Detroit manager in 1920, resigning in 1926, and in the seasons 1927-28 played with the Philadelphia Athletics. He retired later to his home in Georgia.

COBBETT, WILLIAM (1763-1835), British author and journalist, was born at Farnham, Surrey, Mar. 9, 1763. The son of a farmer, he worked in the fields, ran away from home at 14, and largely educated himself while in service as a private soldier. Convinced of speculation and corruption in the army, he tried after his honorable discharge to bring a case against offenders, but was unsuccessful, and fled first to France and then to the United States. Here in 1794 he began his career as a writer, with anti-Radical pamphlets; in 1800 he returned to England, where he founded his famous *Political Register* in 1802, and where he gradually turned to Radicalism. For the remainder of his life he was a power in British politics, always pugnacious, often in trouble, once in jail. He wrote voluminously, kept his paper influential, traveled about rural England and in 1832 was elected to Parliament; he was always an agitator of courage and force. Cobbett died at Botley, Hampshire, June 18, 1835.

COBBING, in ore treatment, the process of breaking and hand-picking good ore from refuse. The lumps are broken by hand hammers, and the ore picked out as the material is carried along on a moving belt.

COBBLE. See GRANITE BLOCK.

COBBLE MOUNTAIN DAM, located on Little River, 15 miles west of Springfield, Mass. This dam is one of the highest earth dams in the world. It is 245 feet high above lowest foundation level, 1505 feet thick at the base and 50 feet wide on top. The volume of the dam is 1,800,000 cubic yards and it is 700 feet long on top. The storage reservoir of 3 billion cubic feet capacity, which it creates, forms part of the water supply system of Springfield. Hydro-electric power is also generated. The spillway is a separate structure at some distance from the dam.

COBDEN, RICHARD (1804-65), British economist and statesman, was born near Midhurst, Sussex, June 3, 1804. A poor boy, with brief and inadequate schooling, he educated himself by study and travel, and in 1835 published a notable pamphlet, *England, Ireland, and America*. In 1839 he was the leader, assisted by JOHN BRIGHT in the foundation of the Anti-Corn-Law League, and he fought against the corn legislation until it was repealed in 1846. His textile business suffered as a result of his public service, but the raising of a national testimonial of \$375,000 in 1846 saved him from financial ruin. Cobden was in Par-

liament from 1841 until 1857 and was again elected in 1859. He was outstanding proponent of free trade in his time and was an early advocate of international policies of peace, arbitration and arms reduction. He died at London, Apr. 2, 1865.

COBH, formerly **QUEENSTOWN**, a seaport, naval station and watering-place of County Cork, lying upon an abrupt rise of the south shore of Great Island, above Cork Harbor, 177 mi. southwest of Dublin. Until late 18th century an insignificant fishing village, to-day it is a port of call of trans-Atlantic liners, having large dockyards, a victualing station and fortifications of the first importance. It is the headquarters of the oldest yacht club in the world, the Royal Cork. Great Island, upon which it is situated, has many drives, and residential and resort sections line its shores. Pop. 1926, 7,077.

COBLENZ, a city in the Prussian province of Rhine, located at the juncture of the Rhine and Moselle rivers. Surrounded by hills, it lies in one of the most beautiful regions of the Rhine. The old city has narrow streets, but the new sections are spacious and have fine houses facing the Rhine. The Church of Our Lady, in the highest part of the town, was begun in 1250 in late-Romanesque style. The Castor Church was founded by Louis the Pious in 836, being finished in its present form in 1208. There are other churches of interest. Of the secular buildings, the residence of the last bishop-elect of Trier, erected 1778-85, deserves mention. The old bridge across the Moselle was begun in 1343. There is considerable industry and heavy shipping. Pop. 1925, 58,322.

COBOURG, the capital of Northumberland Co., Ontario, Canada; situated on Lake Ontario, 70 mi. northeast of Toronto. Passenger and commercial traffic is facilitated by the Canadian National and Canadian Pacific railroads, and by a good harbor open throughout the year. A foundry, canneries, dye works, carpet and woolen mills, a tannery and chemical works comprise local industries. Cobourg is a summer resort particularly attracting Americans. Pop. 1921, 5,327; 1931, 5,834.

COBRA, a term applied more or less widely to various members of the family *Elapidae*, the poisonous colubrine snakes that have a short, rigid fang in the front of each upper jaw. Cobra generally refers, however, to species of the genera *Naja* and *Sepeidon* (*Merremia*). These dangerous snakes are characterized by their "hood" and nervous, vicious temper. The hood is produced by a flattening of the body just behind the head. This is made possible by loose skin and prolonged ribs. The hood is spread when the snake is excited or irritated and its degree of development varies greatly with different species.

Cobras (*Naja* and *Sepeidon*) range from South Africa through southern Asia to the East Indies and Philippine Islands. The single species of *Sepeidon*, the ringhals, is confined to South Africa. In India they are reputed to take an enormous toll of life, both animal and human, but there is no evidence that this

is true elsewhere. In general, these snakes are excitable and aggressive but stupid. During the day at least, they may be picked up with impunity as evidenced by the freedom with which they are handled in the Canton markets and shops. Even the king cobra (*Naja hannah*), attaining a maximum length of 18 ft., the longest of the poisonous snakes, may be freely handled. This snake is perhaps the most ready to attack of any of the species and yet there is abundant evidence that it prefers to retreat under ordinary circumstances. When surprised on or near its nest it may take the offensive and attack with great vigor.

From the foregoing it will be rightfully concluded that professional, snake charmers of the East do not perform a difficult feat in "charming" cobras. One East Indian cobra and some African forms are able to "spit," that is they eject their poison in fine streams for a distance of several feet. This venom, received in the eye of a victim, causes severe pain and irritation but is not fatal.

C. H. P.

COCA (*Erythroxylon Coca*), a small shrub of the coca family, the source of the valuable anesthetic drug cocaine. Coca is believed to have been originally a native of eastern Peru and Bolivia where it was in wide use by the Incas at the time of the Spanish Conquest. It is now commercially cultivated on an extensive scale in various parts of South America, Java and Ceylon; it is also sparingly grown in southern Florida and California. The shrub, which attains a height of 5 to 8 ft., somewhat resembles a small plum, especially the sloe or blackthorn. The slender, rusty-brown branches bear at their tips somewhat tealike, bright green, bristly-pointed leaves. Below the leaves on the reddish wood of the preceding year are borne small clusters of yellow flowers followed by one-seeded, drupelike fruits. Since remote antiquity the custom of chewing coca leaves has been common among the Indians of Peru and adjoining Andean countries where it is estimated that several million people now use the leaves. The dried leaves, mixed with a little lime or other alkali, are chewed three or four times a day. Used in moderation coca stimulates the nervous system, pleasantly exciting the imagination. In larger quantities it paralyzes the nerves of taste and the lining membrane of the stomach, thus removing the sense of hunger so that it is possible for Indian carriers on difficult mountain trails to go without food for two or three days. The coca leaves of commerce are harvested three times a year, exposed in thin layers on woolen cloths, dried carefully in the sun and packed in small bags.

COCAINE, an alkaloid forming large colorless prisms, obtained from the leaves of *Erythroxylon Coca*. It is generally used in the form of cocaine hydrochloride. Cocaine (and its salts) is the oldest representative of the local anesthetics, due to its important action of paralyzing the sensory nerves. Poisoning is often caused by incautious use. Cocaine is a stimulant to the central nervous system, but its use for this purpose is frowned upon because of the inherent

danger of habit formation from this product. It is used by many drug addicts.

COCANADA, a city in the Godavari district of Madras, British India, on a branch of the East Coast Railway. Though Cocanada is the fourth largest port of Madras, its roadstead is so shallow that ships must anchor several mi. from the wharves. The industrial products include tiles, oil, salt and tobacco. The principal export is cotton; rice, sugar and oil-seeds are also exported. Pop. 1921, 53,348.

COCCIDIA, single-celled parasitic microorganisms of the group *Sporozoa*, whose chief characteristic is the habit of living within the cells of the host. The life cycle is also characterized by alternation of generations, an asexual spore formation in one place alternating irregularly with a sexual multiplication at another point. Both of these generations are usually found in the same host. The rapid multiplication of these organisms and the accompanying destruction of the cells in which they live produce serious complications in animals that are infected. Most coccidia live in the epithelial cells of the intestine or communicating organs. The thick shelled oocysts are the only forms that leave the body of the host, they being discharged with the feces and often mistaken for worm eggs. Infection of new hosts is caused by contamination of food or drink.

The coccidia occur commonly in vertebrates. One species, *Eimeria stiedae*, parasitic in liver cells, produces a common and serious epidemic in rabbits. Several species occur rarely in man, only one of which is probably more than accidental. That species (*Iso-spora belli*) came to notice during the World War; it is apparently endemic in the Near East and has spread to other regions since the War. H. B. W.A.

COCHABAMBA, a city of Bolivia, the second in importance, situated on the eastern slope of the Bolivian plateau on the Rocha River almost in the center of Bolivia. It has an elevation of 8,400 ft. and an agreeable climate. Since the advent of a railroad from Oruro, its industrial life has benefited greatly. Cochabamba is a typical agricultural center. The products of the surrounding district are corn, wheat, fruit and vegetables. It was founded in the 16th century, and is noted for the revolutionary activities of some of its women in 1815. Pop. 1930, 36,828.

COCHIMI, a group name applied to a number of American Indian tribes which occupied the California Peninsula and are said to have spoken a single Yuman dialect.

COCHIN-CHINA, a colony of French Indo-China, bounded on the north and northwest by Cambodia, west by the Gulf of Siam, east by Annam and southeast by the China Sea. The area is 24,710 sq. mi.; pop. 1926, 4,118,000, mostly Annamese and 11,077 French.

The colony coincides broadly with the great delta of the Mekong, stretching northeast to embrace some of the southern spurs of the Annamese Cordillera. Large areas of the delta are still occupied by unreclaimed marshes, but 40% of the whole area is classed

as cultivated. Out of 5,740,000 acres cultivated, rice occupies 5,120,000, a proportion which compares with Burma. The production of cleaned rice is 35% of the total crop of all Indo-China. Plowing is done mainly by water buffaloes, of which there are 450,000; other animals include about 400,000 pigs, 15,000 horses, and a few sheep and goats in the hills of the north. Other crops include maize, sweet potatoes, beans, sugar cane, tobacco, coconuts, betelnuts, bananas and also some rubber and cotton. River and coast fishing are actively carried on and fishery products to the value of over \$1,250,000 are obtained annually.

The monsoon blowing from the southwest causes the wet season, May to Oct. and the northeast monsoon causes the dry season, November to April. The average temperature is 81.5°. Some of the mountain spurs reach heights around 3,000 ft., and contain great forests. In these are found numerous wild animals, tigers, leopards, elephants, deers, buffaloes, bears, rhinoceroses and monkeys. Many crocodiles live in the Mekong.

The colony is administered by a Lieutenant-Governor assisted by a Council of Administration composed equally of French citizens and natives.

COCHINEAL INSECT, a Mexican species of scale bug (*Coccus cacti*) from which carmine, lake and other red dyes and paints are made. The females are brushed off plants of nopal (various species of prickly pear cactus) on which they feed. They are killed by heat, dried and treated with specific chemicals to produce desired colors. These were formerly used to dye wool and silk but aniline dyes have almost replaced them.

COCHITI, the name of a Keresan tribe and its pueblo now situated on the west bank of the Rio Grande, 27 miles southwest of Santa Fe, N.M. Though found in their present village by the Spanish explorers, they had previously, with the ancestors of the modern pueblo of San Felipe, occupied other sites to the north, but due to the unfriendliness of the Tewa they were gradually driven to abandon their ancient villages, and finally the tribe was divided, one group building the pueblo now known as San Felipe, the other the pueblo of Cochiti. The Cochiti were prominent in the Pueblo rebellion of 1680. Unlike the usual pueblo terraced houses the Cochiti village consists of one-story detached house units, and a kiva in the plaza. The Cochiti, like most of the other pueblo peoples, though nominally Catholic, still cling closely to their tribal ceremonies, their exogamous clan organization, their rituals connected with shrines and fetiches, to society and kiva memberships and the attendant complicated rites.

COCHRANE, THOMAS, Tenth Earl of Dundonald (1775-1860), English sailor. He entered the navy in 1793 and distinguished himself for heroism. In 1814 he undertook a campaign against the corruption of the fleet, incurred the enmity of the minister of navy, and was arrested on a charge of fraud. Although innocent, he was condemned to

a year's imprisonment and expelled from parliament, but public opinion was against the government, and his seat was restored to him. Re-elected to parliament by Westminster in Mar. 1815, he fled from his cell and appeared in the house, but was retaken and imprisoned. When his sentence was completed, he returned to parliament. In 1818 he took part in the war for independence sustained by Chile and Peru, and, commanding a small Chilean fleet, took the forts of Valdivia (1819) and Callao (1821), leaving Chile mistress of her seas. He received no recompense from these countries, or from Brazil, in whose behalf he fought after leaving Peru, except that the Emperor Pedro I made him Marquis of Maranon. In 1827 he negotiated the peace with Portugal, and went to Greece where he was put in command of naval forces. His severity in putting down piracy compromised his influence and he returned to England, where he devoted himself to the study of advanced nautical science. In 1848 he was made commander of the English fleet in North America and the Antilles, and in 1851 became admiral of the Blue Pavillion, and in 1854 admiral of the British fleet. He wrote *A Narrative of services on the liberation of Chile, Peru and Brazil* (1858).

COCKATOO, one of a group (*Cacatuinae*) of handsome parrots of large size found chiefly in the Australian region, several of which are favorite cage birds. They have conspicuous crests, short stout bills with a nearly perpendicular hook, and usually white plumage tinged with rose-red or yellow. Cockatoos are social in habit, frequenting in large companies the tops of the highest forest trees. They feed chiefly upon nuts, seeds and roots and lay their white eggs in hollow trees or in crevices of rocks. Noteworthy species are the great sulphur-crested cockatoo (*Cacatua galerita*), the white-crested cockatoo (*C. alba*), and the rose-crested cockatoo. The great black or palm cockatoo (*Microglossus aterrimus*), about 2½ ft. long, with an enormous bill ending in a needle-like point and slaty black plumage, is the largest of the group.

COCKATRICE, a mythical animal represented in heraldry as a serpent with a cock's head and legs, and a dragon's wings. It was supposed to be hatched by a snake from a cock's egg. People believed in the existence of this creature during ancient and medieval times. It was supposed to be a malignant monster, enemy of man, animals and plants, possessed of the evil eye, and able to kill by a glance. The only living thing which could withstand the cockatrice was thought to be the weasel. Cockatrice appears to have been used as synonymous with *BASILISK*.

COCKCHAFER, another popular name for *JUNEBUGS* or *May-beetles*. Adults do considerable damage by feeding on foliage. Larvæ, commonly known as white grubs, are destructive to many crops, feeding on the roots.

COCKFIGHTING, the practice of pitting gamecocks, is of uncertain origin, but is known to have been popular with both Greeks and Romans. In the face of

hostile criticism and of legislation prohibiting the practice, cockfighting has nevertheless flourished in this century, although largely restricted to England, the United States, Spanish-America, Cuba, the Philippines, China, Persia and Malacca. Fighting gamecocks are from one to two years old, and should weigh about 4 pounds, 8 ounces. The birds are armed with short heels or long heels, consisting of spurs 1½ and 2½ inches in diameter respectively. The wings, tails, rump and comb are trimmed. The battle is staged in a pit, and once the birds are pitted, the owners may not touch their cocks, save to disengage the spurs.

COCK LANE GHOST, an apparition based on the celebrated tale of mysterious scratching sounds and



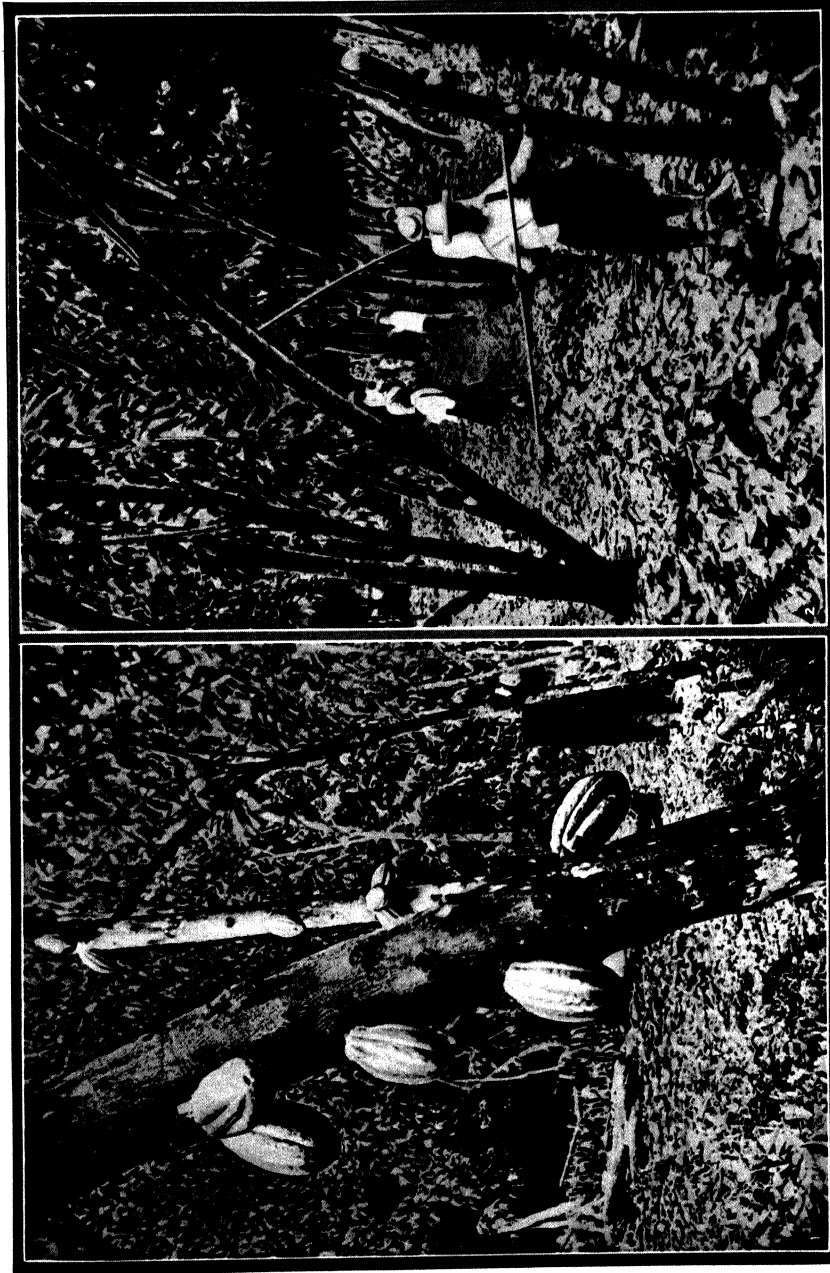
COURTESY IOWA GEOL. SURV.

COMMON COCKLEBUR
Xanthium canadense

other noises in a house in Cock Lane in London in 1762. It aroused great interest and was reported by Dr. Samuel Johnson, who shared the general view that it was an imposture. Hence "Cock Lane" came to be an expression for fraud. In the incident, as in the origin of *SPIRITUALISM*, a young girl figures as the source of the noises; but as the ghost made an accusation of murder the case became sensational.

COCKLE, a marine bivalve mollusk of the genus *Cardium*. There are about 200 species of cockles, the best-known being the common British edible cockle, *Cardium edule*. Of American cockles, which are not edible, the most notable is the giant cockle (*Serripes groenlandicus*) of the Labrador coast. *Cardium pinulatum* is common along Long Island Sound, and *Cardium islandicum* is found north of Cape Cod. Cockle shells somewhat resemble clam shells in shape, but they are prettily marked with radiating sculp-

COCOA

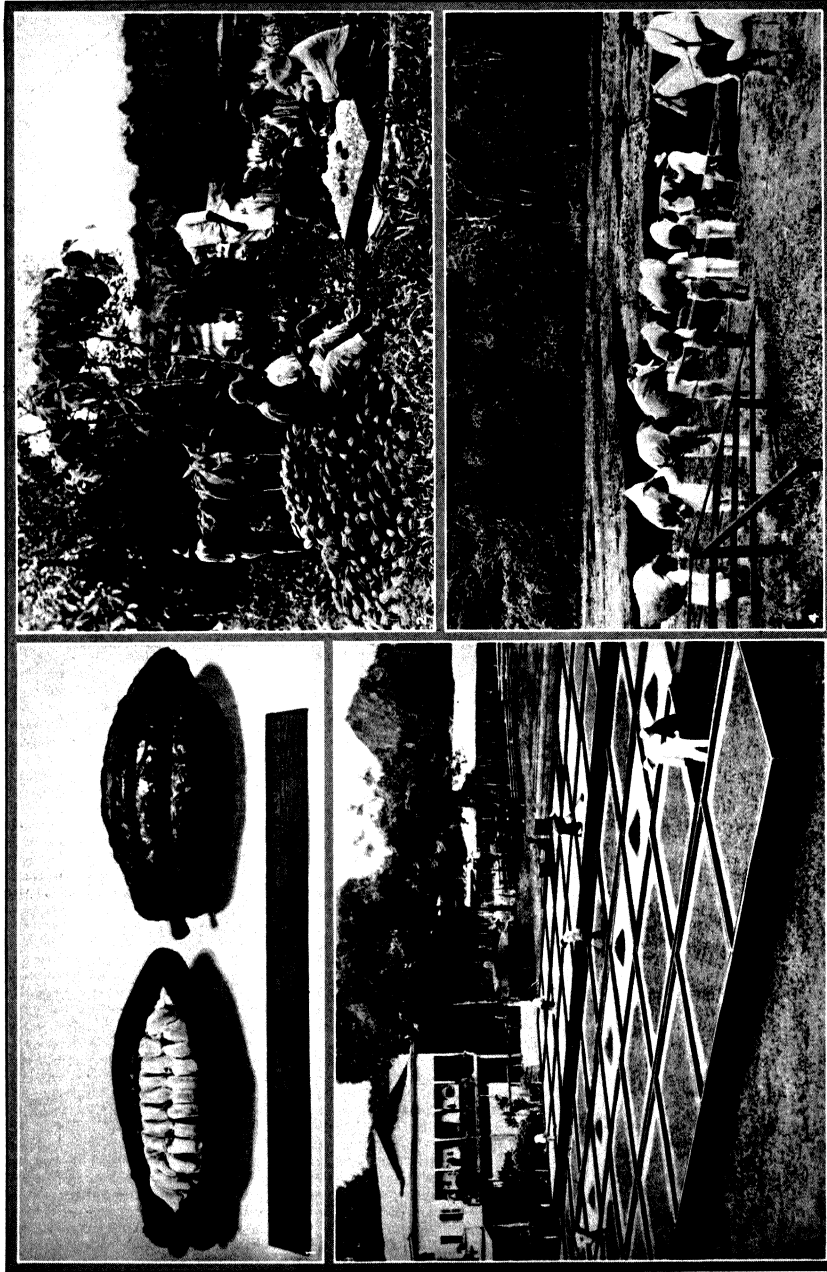


COURTESY HERSHEY CHOCOLATE CORP.

THE SOURCE OF OUR COCOA AND CHOCOLATE

1. Cacao trees with their pods. From their oil comes cocoa butter and from their pulverized seeds cocoa and chocolate.
2. Picking cacao pods, a typical scene in Central and South America, the West Indies and in Mexico.

COCOA



COURTESY HERSHEY CHOCOLATE CORP.

THE CULTIVATION OF CACAO IN CENTRAL AMERICA

1. Cacao pods, showing the arrangement of the beans. 2. Cutting the cacao pods and extracting the beans.
3. Drying cacao beans in the open air. 4. Loading the beans in long dugouts for shipment.

tured ribs. The cockle has a strong foot which it uses for burrowing in the sand, where it buries itself. It feeds on tiny forms of life.

COCKLEBUR, the common name given to a genus (*Xanthium*) of coarse annual plants of the composite family. There are several species, some exceedingly pernicious weeds, found widely throughout the world. They are mostly stout, rough-hairy, branching plants, with the male and female flowers borne in separate clusters. The fruiting receptacles develop into large prickly burs that cling to the fur of animals, in some regions impairing the value of wool.

COCK-OF-THE-ROCK, a genus (*Rupicola*) of exceedingly handsome birds of the chatterer family (*Cotingidae*) found in northern South America. They are about the size of a pigeon, the males having bright orange or red plumage and a conspicuous disklike crest; the females are dull olive-brown. These birds frequent dense forests along rocky watercourses,



DRAWING BY GEORGE MIKSCH SUTTON

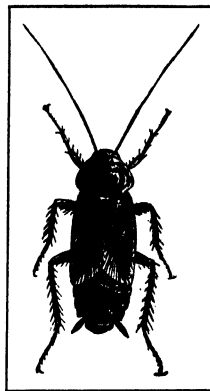
COCK-OF-THE-ROCK

building nests of mud and moss on cliffs or within caves. At mating time the males congregate to court the females, performing, one at a time, various curious antics which display their gorgeous plumage. The best known species, *R. crocea*, is a favorite cage bird in the Amazonian region; it also is highly prized for its skin and feathers used for numerous decorative purposes and in millinery. The flesh is sometimes eaten.

COCKRAN, WILLIAM BOURKE (1854-1923), American lawyer, orator and Congressman, born in County Sligo, Ireland. He attended grammar school in Ireland, and studied for a time in France. Refusing to enter the church, he went to New York at 17 years of age. Beginning to work in a department store, he later became principal of a Tuckahoe, N.Y., public school. He was admitted to the bar in 1876, and began to practice in Mt. Vernon. Two years later he moved to New York City, and became a member of the Irving Hall Democracy, the oppo-

sition to TAMMANY HALL. He joined the Wigwam in 1883, and was appointed counsel to the New York Co. sheriff. He was elected to the House of Representatives in 1886, 1890 and 1892. He supported WILLIAM MCKINLEY in 1896, but campaigned for WILLIAM J. BRYAN in 1900. He was elected in 1904 to Congress, where he remained for the next five years. In 1920 he placed ALFRED E. SMITH in nomination for the Presidency. In the same year he was again elected to Congress, where he served until his death on Mar. 1, 1923.

COCKROACH, various species of insects of the family *Blattidae*, widely distributed through the world especially in the tropics. They have oval and flattened bodies with mouthparts fitted for chewing. Some species are wingless, others are winged. Many species live out-of-doors, but others have become serious household pests. They are general feeders, destroying food and injuring books and many kinds of merchandise. Their disagreeable odor makes them doubly objectionable. They are largely nocturnal, spending the day in cracks and crevices, often near steam pipes. The eggs, contained in capsules, are often carried by the female for several days. The nymphs resemble adults in form. The species most common in buildings in the North are the Crotonbug, the oriental cockroach, and two native American species. Commercial sodium fluoride is an effective means of control.

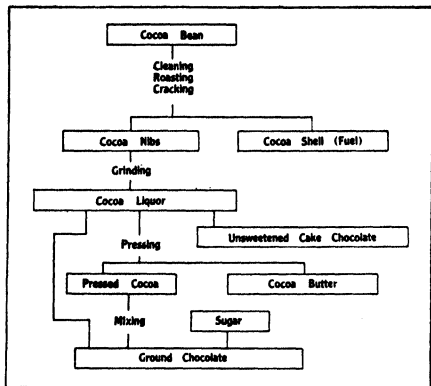


ORIENTAL COCKROACH
Blatta orientalis

COCKSCOMB (*Celosia argentea* var. *cristata*), a showy annual garden flower of the AMARANTH family. It is widely cultivated in numerous forms for its dense, convoluted, crested or feathered, comblike flower-heads ranging in color from red to purple, yellow and white. The parent species from which the numerous garden races have been derived is a widespread weed in tropical countries, probably originally a native of Asia.

COCOA, a pulverized chocolate made from the seeds of cacao, the tropical tree, *Theobroma cacao*. The cacao beans are roasted and crushed into a smooth chocolate liquor. Part of the cacao butter is then pressed out and the remaining hard cake finely ground and sifted. Various cocoas contain different amounts of cacao butter. "Breakfast cocoa" is required to contain not less than 22% of cacao butter. Sweet cocoas and sweet milk cocoas are made by mixing cocoa with sugar and milk. "Dutch process" cocoas are those which have been given an alkaline treatment chiefly to obtain a darker color.

A chocolate-flavored beverage made of cocoa, milk or milk and water, and sugar is also called cocoa. Before serving, cocoa is "milled" or beaten until light and frothy and then served hot or iced. Because of its nutritive value and digestibility, it is especially good



COURTESY D. GHIRARDELLI CO.

FLOW SHEET OF COCOA MANUFACTURE FROM THE COCOA BEAN

for children. Cracked cocoa is a sweetened beverage made from cocoa nibs.

COCO DE MER (*Lodoicea maldivica*), a very large palm allied to the Palmyra palm, called also Maldive nut and double coconut. It is found only in two small islands in the Seychelles group, which were discovered in 1743. Prior to that time the immense woody nuts had long been found floating upon the sea or stranded on the shores of the Maldiv Islands. Many fabulous tales arose concerning their origin and supposed medicinal virtues.

This magnificent palm, which grows 100 ft. high and requires about 100 years to attain maturity, is remarkably large in all its parts. The huge fan-shaped leaves are sometimes 20 ft. long and 12 ft. broad. The fruits, which are commonly borne in clusters of 5 to 10, frequently weigh 40 to 50 lbs. and require about 10 years to ripen. They consist of a thick outer fibrous husk surrounding usually a single nut with an exceedingly hard, black shell divided about half way down into two lobes, whence the name double coconut. The gigantic seed, probably the largest known, requires about three years to germinate. The flesh, which somewhat resembles that of the coconut, is edible. In former times important curative properties were attributed to the nuts. Water drunk out of vessels made from the shells was believed to protect people from all ailments. Various utensils are now manufactured from the shells; the nuts themselves are sometimes sold as curiosities.

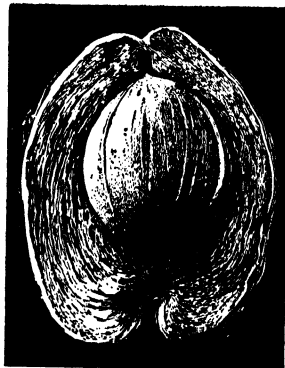
COCONUT PALM, a tall palm, botanically known as *Cocos nucifera*, native probably to tropical Asia and the Malayan Islands, in cultivation there

since prehistoric times and consequently widely distributed through the tropics of the Old World and Oceania, usually at low altitudes and seldom far from the coast. Introduced into America very soon after the discovery of that continent, it is now widely grown throughout the American tropics and is hardy in southern Florida. Its immense leaves are of the pinnate type, its stems are frequently bent by the wind, and it forms a picturesque ornament to all tropical coasts. It is cultivated extensively in many regions and its fruits and their products have become important articles in international trade and industry.

Few plants are useful to man in as many different ways as coconut. Its wood is used for native buildings; its leaves thatch the native houses; its sap is fermented into a liquor; the milk of the young fruits is used as a beverage and the young tender flesh as food; the shell is shaped into various utensils; the fiber of the husk, commercially known as coir, is woven into coarse cloth and rope. In northern zones coir is largely used in the manufacture of matting, the shredded kernel is commonly used as food, and oil expressed from the mature fruit is important in the manufacture of soap, butter substitutes, and various other commodities. In cultivation, coconuts begin to bear in about 8 years and yield a steady crop for half a century.

H. A. G.

Coconut as Food. The meat of the nut, about one-half inch in thickness, is encased in a hard spherical shell, in the central cavity of which is a watery solution called coconut milk. The meat is eaten fresh,



COURTESY H. Y. BOTANICAL SOCIETY

COCONUT IN HUSK (*Cocos nucifera*)

or is dried. The dried flesh is utilized in two ways. When thoroughly dried in the shell, *copra*, the resulting product, is subjected to high pressure to squeeze out the fat, *coconut oil*. The residuum is used for cattle food.

While the coconut flesh is eaten raw, by far the greater quantity is consumed in the form of shredded coconut, prepared in the following manner. The nuts

are steamed, cracked and the shell removed leaving the shelled kernel intact. This is trimmed and then cut in half so that the juice runs out. The halves are then washed and shredded. Sugar, a little salt and glycerine are added and the whole cooked at about 200° F. Then the mixture passes through a hot air tunnel whence it emerges in the finished form containing only 3% or less of moisture. Canned shredded cocoonut is prepared in a similar manner except that it is not dried so drastically. It contains about 15% moisture and is sealed in cans in an atmosphere of carbon dioxide. This product has a fresher taste than the drier form sold in paper packages. A. W. T.

COCOON, the silken case spun by the mature larva of many insects, especially moths, prior to becoming a pupa. Often it is made in a rolled leaf, in grass or rubbish or in cells below ground. In some cases (for example, the silk worm) it is one continuous thread. In others it consists of caterpillar hairs, chips or fragments of earth held together by the silk, or it may be merely felted, designed as a protection against enemies, rain and snow, and sudden changes of temperature.

COCOPA, a North American Indian tribe of the Yuman linguistic stock. Their earliest known habitat was near the mouth of the Colorado River; later they are known to have lived in the mountains of lower California. They were a warlike group, frequently at odds with the nearby Yuma and Mohave. Culturally they resemble the YUMA. They were agriculturists, growing maize, melons and beans, to which diet they added seeds and roots. For shelter they used a simple brush structure in summer and in winter a mud-plastered wattle house.

COCO PLUM (*Chrysobalanus Icaco*), a shrub or small tree of the rose family, called also icaco. It is native to southern Florida and widely distributed in the tropics where it is often planted for ornament and for its sweetish, plum-shaped fruits. The coco plum is usually a broad-topped shrub about 10 ft. high with thick, glossy leaves, numerous small white flowers in axillary clusters and a smooth, pink, yellow or creamy-white globular fruit.

COCOS ISLANDS, also called Keeling Islands, a group of some 20 coral islets of the Indian Ocean, lying about 581 mi. southwest of Java and over 1,000 mi. from Singapore, to which they are attached for purposes of administration. The Cocos are noted for the immense flocks of various sea birds which dwell on them. Copra oil and coconuts are the principal products. The group was occupied by Great Britain in 1857. In 1903 it was joined to Singapore and thus became part of the Straits Settlements. The total population of the Cocos is less than 1,000.

COCTEAU, JEAN (1892-), French poet, dramatist and critic, was born at Maison Lafitte, July 5, 1892. His poems are collected in *Poésie*, published in 1916. Among his dramas, *Oedipe-Roi* is a free adaptation from Sophocles's *Oedipus Rex*. *La Voix Humaine*, *Pièce En Un Acte*, appeared in 1930. Among other works of Cocteau are *Le Grand Écart*, a novel,

Lettre À Jacques Maritain, a philosophic correspondence, and the critical-aesthetic writings, *Poésie Critique* and *Le Coq D'Arlequin*. His *Opium* appeared in 1932.

COCYTUS, the modern Vuvo, a tributary of the Acheron in Epirus, and one of the rivers of HADES in Greek mythology. The name signifies "wailing."

COD, a family (*Gadidae*) of mostly marine fishes, found in northern seas, several of which, as the cod, HADDOCK and POLLACK, are of great economic value. They are mainly cold-water fishes with elongate, slightly compressed bodies, spineless fins and very small scales.

The common codfish (*Gadus callarias*) is abundant on both shores of the North Atlantic. One of the world's most important food fishes, it supports, like the herring and salmon, extensive fishing industries, employing hundreds of vessels, especially on the coasts of Norway, Newfoundland and New England. The codfish has a large head and mouth, with a barbel on the lower jaw. In color it varies from greenish to brownish and reddish, marked with numerous brown spots and a whitish lateral line. Its average weight is about 10 lbs., but a weight of 50 lbs. is not rare, and occasionally a specimen exceeds 200 lbs.

While the cod is found at depths of 1,500 ft., it commonly frequents shallow water and often comes close to shore. It is a voracious bottom-feeder, subsisting largely on mollusks, which it swallows whole, and also on worms, crustaceans and other fishes. Codfish are immensely prolific, spawning in the open sea, a single large female usually laying several million eggs. The white, flaky, rather flavorless flesh, variously preserved by salting and drying, forms a staple food product shipped to all parts of the world. Cod livers yield an easily digested, highly nutritious oil of great medicinal value; the air bladders are made into isinglass.

The very similar Alaska codfish (*Gadus macrocephalus*) occurs in great abundance in the North Pacific, from Oregon to Alaska and Japan.

In 1929 the total catch of cod by U.S. fisheries amounted to 116,652,000 lbs., valued at \$3,541,000; the Canadian catch was 1,979,440 cwt., with a value of \$4,040,562. The total exports of preserved codfish from Newfoundland in 1929 were 1,293,502 quintals, valued at \$11,823,588. See also TOMCOD. A. B. J.

C.O.D. See CASH ON DELIVERY.

CODA, a musical tail-piece or short concluding section of a composition, or of a movement, especially noteworthy in the works of Beethoven. Although in the nature of an afterthought, it should be an integral part of the composition and thus might be compared with a pertinent jest or epigram illuminating the discourse which has preceded it.

CODEINE, a colorless, translucent powder, odorless, called also methylmorphine, slightly soluble in water and freely soluble in alcohol, occurring in OPIUM but generally prepared from morphine by methylation. Codeine or its salts (which are generally employed) are used for the relief of pain, for producing sleep, or quiet, and are particularly useful in

coughs. The effects resemble somewhat those of morphine, but codeine is much less likely to produce the drug habit than morphine.

CODE NAPOLEON, now called the French Civil Code. After the French Revolution, Napoleon appointed a commission to codify the laws of France. On the commission's report the Code was finally enacted in 1804. This Code, together with the Code of Commerce, the Penal Code, Administrative Code and the Acts of the Chamber of Deputies, constitute the law of France. The codes of twenty-six countries, including Louisiana and Quebec, and all the South American countries, with the exception of Brazil, are modeled after the Code Napoleon.

CODES, NAVY. The U.S. Navy uses commercial codes, the International Code of Signals, the Navy General Signal Book and various secret codes, the latter being greatly added to in war time. Signals may be communicated by visual method, by radio, cable, telephone or otherwise. Usually navies communicate by a cipher code; a special code is used for tactics and fleet maneuvers, while a third code is used for smaller vessels where fewer signals are needed. There are also transport codes and codes for naval attaches serving abroad.

CODIÆUM, a small genus of trees and shrubs of the spurge family, natives chiefly of the eastern tropics. One of these (*C. variegatum* var. *pictum*), commonly called croton, is widely grown in gardens in the South and in greenhouses in the North for its handsome variegated foliage.

CODICIL, an addition to a WILL which has been duly executed and witnessed. The codicil may contain new matter; it may amend some of the provisions of the will, or it may revoke some. It is construed as part of the will and so probated, and when properly executed may pass REAL PROPERTY. In one case, a testator executed a codicil which he described "as a codicil to my will executed some years ago." The will could not be found, but probate of the codicil was granted.

CODLING MOTH, a small, inconspicuous brownish moth of the family *Olethreutidae*. Their eggs are laid on foliage and newly formed apples and related fruits. The pinkish, fleshy larvæ of the first brood enter the fruit at the blossom end, eat cavities especially near the core and burrow to the surface. They crawl to suitable shelter, usually under the bark of the tree, and pupate. Larvæ of the second brood may enter apples at the calyx end, the stem end, or through the side. They wait until spring to pupate. These insects are one of the chief causes of wormy apples and pears. Two broods and a partial third brood may be produced each year. Though lead arsenate is the best insecticide for this worm, it must be applied immediately after the blossoms fall, while the calyces are still open, so poison may lodge inside. As larvæ feed also on foliage, a second spraying is advisable two or three weeks later. To control the second brood, another spraying the latter part of July, and sometimes another, are necessary. J. R. T.

COD LIVER OIL, an oily liquid, pale yellow, having a characteristic fishy odor and flavor, which is rendered chiefly from the fresh livers of the codfish.

Norway leads in the production of cod liver oil, but the oil is rendered in large quantities in Finland, Newfoundland, Labrador and Japan or wherever cod fishing is carried on extensively. Codfish are voracious eaters, consuming small fish, especially caplin. These smaller fish feed on crustaceans which in turn consume large quantities of marine vegetation or algae. In this unique way the codfish obtain food which have an important bearing up on the quality of oil obtained from the livers.

Though the specific value of cod liver oil was not scientifically demonstrated until the early part of the twentieth century when the specific vitamins were discovered, many of the primitive island peoples living in the northern Atlantic were acquainted with its virtues before they came in contact with civilization. It was used for medicinal purposes in the latter part of the eighteenth century, and has been used in Europe as a general body builder since that time in debilitating conditions, such as pulmonary diseases, anemia, etc.

H. G. P.

Cod liver oil has exceptional medicinal properties which, although recognized in a general way for generations by the laity and by the medical profession, have been established scientifically only during the past few years. Its distinctive virtue is due to the fact that, in addition to being very readily absorbed, it contains two of the most important VITAMINS in very high concentration. These are vitamin A, or the fat-soluble factor, and vitamin D, or the antirachitic factor. The former is found especially in animal fats and in the leafy vegetables. It is a necessary ingredient for normal growth and well-being and protects against a specific eye disease (XEROPHTHALMIA) which is common in the Far East. The D vitamin is specific in the prevention and cure of RICKETS, which is the most common nutritional disorder of young children in the temperate zones; this disorder is characterized by deformities of the bones such as bow-legs, knock-knee, and malformation of the pelvis. The oil is likewise a specific against *tetany*, which is a nervous disorder of infants closely allied to rickets and is characterized by CONVULSIONS which may result even in death. Cod liver oil is also fed to animals, for example, to puppies and particularly to chickens in order to protect them against rickets or "leg weakness." This vitamin may be also supplied by means of the direct rays of the sun, by artificial ultra-violet irradiation (see LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE) or by foods which have been subjected to the ultra-violet rays (see IRRADIATED FOODS). A. F. H.

CODY, WILLIAM FREDERICK (Buffalo Bill) (1846-1917), American frontiersman, was born in Scott Co., Iowa, Feb. 26, 1846 and moved to Kansas in 1851. At fourteen he was a rider on the pony express and during the Civil War acted as a scout. During the construction of the Kansas Pacific Railway, 1865-70, he provided buffalo meat for the

construction gangs and so earned his famous nickname. He organized his famous Wild West show in 1883 and took it to Europe in 1887. He established a school for rough riders in Wyoming in 1901, and Cody, Wyo., was named for him. He died at Denver, Colo., Jan. 10, 1917.

COE COLLEGE, a coeducational institution at Cedar Rapids, Ia., chartered in 1881, privately controlled and affiliated with the Presbyterian Church. Previous to 1881, it was known as Coe Collegiate Institute, so named in honor of Daniel Coe of Durham, N.Y., who donated the funds to purchase a site. In 1919, Leander Clark College of Toledo, Ia., was consolidated with Coe. The endowment fund in 1931 was \$1,810,747. The library contains 30,655 volumes. In 1930 the student enrollment was 767, and the faculty of 62 was headed by Pres. Harry M. Gage.

COEDUCATION in its strictest sense is education of the two sexes in the same classes. In a broader and more generally accepted sense, it is the education of the two sexes in the same institution with the same advantages, but not necessarily exclusively identical courses. Thus there are some courses attended only by men, others by women, because of their different interests. In the United States, coeducation has found its strongest advocates, and it is the prevailing system not only in the elementary and secondary schools but in the universities. In other countries coeducation in elementary schools has been widely adopted, but in the secondary institutions, with few exceptions, there is still a strong though weakening prejudice against educating the two sexes together. The opening of universities to women is comparatively recent.

The State system of education throughout the United States has from the first been coeducational, and in the West there has been little attempt to establish schools or colleges exclusively for either sex. In the East separate universities have been opened, some of these being established before women won their struggle for higher education. Coeducation in secondary schools received its impetus through the efforts of Horace Mann in 1826 in Massachusetts. Oberlin College admitted women in 1833, and in 1855 Antioch College was established as a coeducational institution. Before the end of the 19th century, numerous other coeducational colleges had been established, and a number of those founded for men had opened their doors, however grudgingly, to women. There are to-day few colleges which still refuse admission to women even in their professional schools.

M. R.

COELENTERATES, Coelenterata, an important subdivision (phylum) of invertebrate animals ranking between the sponges (Porifera) and the comb-jellies (Ctenophora). The coelenterates are characterized by very simple structure, with the body wall of two layers, ectoderm and endoderm, enclosing a single gastrovascular cavity. The phylum includes the polyps, jellyfishes, sea-anemones, sea-pens, and

stony corals. *See also* CORAL; JELLYFISH; ZOOLOGY; Phylogenetic System.

COELOSTAT. An instrument for providing, by REFLECTION from a moving mirror, a stationary image of a celestial body. The image may be viewed with an astronomical TELESCOPE or projected upon the slit of a spectrograph (*see* SPECTROSCOPY). When the coelostat is employed, the relatively heavy telescope or spectrograph may be stationary, and it is only necessary to move the light-reflecting system. It is generally employed on solar eclipse expeditions, where the usual mounting of a telescope is impossible. The coelostat commonly consists of two mirrors, one of which is mounted on an axis parallel to that of the earth. This axis is turned by clockwork at the rate of one revolution in 48 hours. The other mirror is fixed and requires adjustment only at infrequent intervals.



COURTESY AMER. MUS. OF NATL. HISTORY
TUBULARIAN HYDROID, A
COELENTERATE

Tubularia harrimani

COERCIVE FORCE. *See* MAGNETIC INDUCTION.
COEUR D' ALÈNE, the popular name for the Skitswish, a Salish-speaking American Indian tribe which lived on a river and lake of the same name in Idaho. They now live on the Coeur d'Alène Reservation in Idaho.

COEUR D'ALENE, a city in northern Idaho, the county seat of Kootenai Co., is situated on Lake Coeur d'Alene, 34 mi. east of Spokane, Wash.; it is served by bus lines and several railroads. There is an airport. The city is the metropolis of the Idaho Panhandle, a rich farming and lumbering region. Fruit, alfalfa, poultry and dairy products are the chief agricultural interests. Lumber milling is the principal local industry. The city is beautifully situated at the foot of the Coeur d'Alene Mountains; to the north and west is Rathdrum Prairie. Lake Coeur d'Alene and the smaller lakes, Hayden and Fernan, afford fine fishing and hunting. Father Luther de Smet founded a mission here in 1842; the city was incorporated in 1906. Pop. 1920, 6,447; 1930, 8,297.

COEUR DE LION, meaning lionhearted, the nickname applied to RICHARD I of England.

COFFEE (*Coffea arabica*), a woody plant of the madder family, native to tropical Africa, ranking with tea among the leading beverage plants of the world. Wild coffee is a slender evergreen tree 15 to 20 ft. tall, with glossy, laurel-like leaves and starry, jasmine-scented, white flowers. In cultivation, now general in the tropics, it is kept down to shrub dimensions, 6 to 9 ft. It bears sweet, pulpy berries, or "cherries," deep

crimson at maturity, enclosing twin seeds, which are flattened on one face. When cleared of pulp and hulls, these become the coffee beans of commerce. They contain a stimulating principle, caffeine, similar to the theine of tea.

The plant thrives best at altitudes of 100 to 2,000 ft. with a temperature range of 60° to 90° . This single species supplies the bulk of the world's coffee, though others, notably *C. liberica*, are cultivated.

As a beverage, coffee was introduced from Abyssinia to Arabia, probably in early Mohammedan times. It reached Cairo about 1500, and was established throughout the Near East a full half-century before its use became general in Europe, about 1650. The plant was carried by the Dutch from Arabia to Java in 1696, was introduced into India in 1700, and into Brazil by 1740.

Because of its content of CAFFEINE, coffee is used as a stimulus to the respiration, circulation and particularly to the higher brain centers of the human being. The percentage of caffeine varies in different brands of coffee. In Arabian coffee it is from 0.7 to 1.6%. Some other brands run as high as 2% in caffeine content. In order to have the pleasurable effects of coffee without the stimulating effects, special brands of coffee are now available from which the caffeine has been removed almost wholly.

Before use, the seeds of the coffee fruit are dried and the pulp and parchment are removed. The coffee beans are then graded and roasted. In the roasting process gases develop from the aromatic oils which are largely responsible for the flavor or taste of the coffee.

The making of coffee as a beverage includes the selection of a good quality of fresh-roasted berry, clean utensils, clean coffee, proper grinding, freshly boiled water, correct proportions and proper timing.

COFFEE BREWING. Four methods of brewing coffee are in general use: Boiling, Percolating, Filtering and Dripping. To make boiled coffee, use one dessert spoonful of coarsely ground coffee per cup of coffee desired, pouring it into the water when it reaches the boiling point and allowing the mixture to steep for about five minutes. The shell and white of an egg is sometimes added to the mixture to improve the flavor and to clear, or "settle," the brew. In making percolated coffee, fill the pot to the spout with cold water and fill the percolator cup almost to the brim with medium ground coffee. The water should then be brought to a boil and allowed to percolate for about ten minutes. Filtering requires a special apparatus consisting of an upper funnel holding finely ground or pulverized coffee on a piece of filter cloth, and a lower bowl into which the desired amount of water is put. These two parts of the apparatus are connected in an air-tight manner, generally by a rubber cork. When the water in the lower bowl boils, it is forced up through the funnel by the pressure of the steam into the upper container where it meets the coffee. It then filters down to the lower bowl through the coffee and is ready to serve. Dripping is

a simplification of the foregoing method. Water at or near the boiling point is poured directly on pulverized coffee held by a filter cloth or, in the *Trico-lator*, a special filter paper.

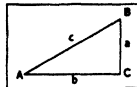
L. W. R.

COFFEYVILLE, a city in Montgomery Co., southeastern Kansas, situated on the Verdigris River, 160 mi. southeast of Wichita. Bus, traction and truck lines and three railroads afford transportation. Coffeyville Municipal Airport is near by. Coffeyville is located in the rich central gas and oil region of the United States. Wheat, corn, fruit and dairy products are grown in the vicinity. The city has oil refineries, flour mills, a milk condensery and oil-well machinery shops. In 1929 the manufactures were valued approximately at \$20,000,000; the retail trade amounted to \$8,046,612. Coffeyville was founded in 1869 and incorporated in 1872. There are salurian medicinal springs near by. Pop. 1920, 13,452; 1930, 16,188.

COFFMAN, LOTUS DELTA (1875-), American educator, was born in Salem, Ind., Jan. 7, 1875. He studied at Indiana State University and at Columbia, and from 1896-1907 was successively principal and superintendent of schools in Indiana. From 1912-15 Coffman was professor of education at the University of Illinois and from 1915-21 served as dean of the college of education at the University of Minnesota where he became chancellor in 1921. He was coeditor of the *Journal of Educational Administration and Supervision* and the author of *The Social Composition of the Teaching Population*.

COFRE DE PEROTE, an extinct volcano in the state of Vera Cruz, Mexico, about 15 mi. west by north of Jalapa. This is the Nauhcampápetel or four-crested mountain of the Aztecs and its Spanish name meaning coffer or chest has reference to the square form of its summit. Its crater and several parasitic cones on its flanks have so long been extinct as to be partially obliterated. The mountain reaches a height of 13,415 ft. above sea level and is the twin peak of Orizaba to the south, the highest summit in Mexico.

CO-FUNCTIONS. In trigonometry there are three direct functions commonly used, the sine, tangent and secant. In the triangle here shown, $\angle B$ is the complement of $\angle A$; that is, $\angle B = 90^{\circ} - \angle A$. The sine of B is therefore the sine of the complement of A , and is called the cosine of A , written "cos A ." Similarly we have the cotangent of A (cot A) and cosecant of A (csc A). See TRIGONOMETRY.



COGNITION, one of the three main aspects of consciousness. In its narrower sense it refers to the awareness of an object; in its broader meaning it includes the whole field of intellectual processes. Knowledge is the cognitive phase of experience. As such it may include sensation, memory, imagination, and the more complex processes of reasoning. Older authorities would also include intuition in this category. Sensation is the element of cognition just as pleasure and pain are the elements of feeling and simple impulses of will. This treatment of cognition

COFFEE

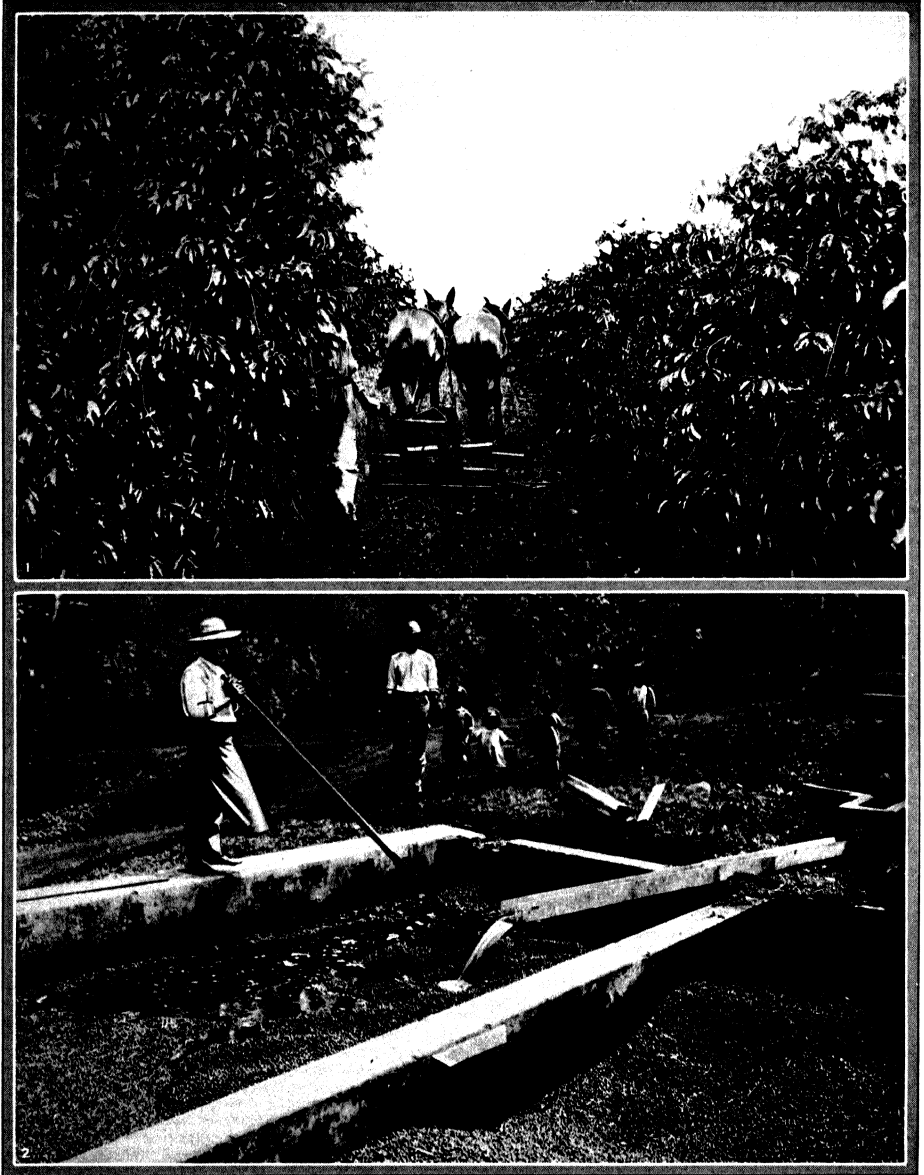


COURTESY BRAZILIAN AMERICAN COFFEE PROMOTION COMMITTEE

HARVESTING COFFEE ON A LARGE BRAZILIAN PLANTATION

1. Workers picking coffee berries by hand on a Brazilian plantation.
2. Drying coffee in the sun on the drying floor.
3. Roasting, a process in which the greatest care must be taken to obtain the proper flavor in the coffee bean.

COFFEE



COURTESY BRAZILIAN-AMERICAN COFFEE PROMOTION COMMITTEE

PROCESSES IN THE PRODUCTION OF COFFEE

1. Preparing the soil for sowing coffee seeds. At left, full grown trees, which in Brazil attain a height of from 17 to

19 ft. 2. Washing the coffee berries in a shallow tank preparatory to spreading the berries to dry in the sun.

is according to the older structural psychology which analyzed consciousness into its component parts.

COGS. See GEARS and GEARING.

COHAN, GEORGE MICHAEL (1878-), American actor-manager and composer, was born at Providence, R.I., July 4, 1878. His first stage appearance was at Haverstraw, N.Y., on Feb. 19, 1888, as a violinist in *Daniel Boone*. He toured with his family, a vaudeville troupe known as the "Four Cohans," in *Four of a Kind*, later playing the title rôle in *Peck's Bad Boy*. His first successful song was *Venus, My Shining Love*. Among his plays were *Little Johnny Jones*, 1904, *The Yankee Prince*, 1908, *Get-Rich-Quick Wallingford*, 1911, *Forty-five Minutes from Broadway*, 1912, *Seven Keys to Baldpate*, 1913, and *The Tavern*, 1920. In partnership with Sam Harris he built the George M. Cohan Theatre, and the Cohan and Harris Theatre, New York City. In his works and as an actor Cohan was typical of the restless, aggressive American spirit. In 1917 he composed the popular war song *Over There*. Later plays were *American Born*, 1925, *Baby Cyclone*, 1927, and *Gambling*, 1929.

COHEN, ERNST JULIUS (1869-), Dutch chemist, was born at Amsterdam, Mar. 7, 1869. In 1893 he became assistant to Van't Hoff in the latter's chemical laboratory at Amsterdam. In 1902 he became professor of physical chemistry at Utrecht. He investigated and wrote upon problems of the allotropy of metals and of electro-chemistry.

COHERER, an early form of radio DETECTOR which operates on the principle that the RESISTANCE of a column of metal filings in a glass tube is reduced by the passage of high-FREQUENCY current.

COHESION, the sticking together of two bodies made of the same material without the help of an intermediary substance such as glue. It is caused by forces of attraction between like MOLECULES. That large forces are involved is shown by the amount of work needed to stretch, hammer, plane or saw a body. Although very great in the immediate neighborhood of a molecule, these cohesive forces are not appreciable at distances greater than 0.000005 cm.

The molecules on the surface of a liquid are drawn inward by cohesive forces, causing an apparent surface film analogous to a tightly stretched rubber skin. For this reason, falling raindrops are shaped like balls, the cohesive forces producing a SURFACE TENSION which reduces the surface to a minimum. Soap bubbles and capillary action may be explained in quantitative fashion by considering these forces. Pouring oil on water decreases the surface tension, and eliminates the small ripples (see CAPILLARY WAVES), so that the wind which causes the larger waves slides over a smooth surface. See also SOLID STATE, THEORY OF. J. B. H.

BIBLIOGRAPHY.—Millikan, Gale and Edwards, *A First Course in Physics for Colleges*, 1928; Millikan, *Mechanics, Molecular Physics and Heat*, 1902.

COHOES, a city of Albany Co., N.Y., situated on the west bank of the Hudson River, 9 mi. north of

Albany. It is served by the New York Central and the Delaware and Hudson railroads. The Mohawk River supplies abundant water power, and Cohoes is an important manufacturing city, producing cotton-, woolen- and knit-goods, paper, shirts, and iron and steel work. Cohoes was settled by the Dutch about 1630. Pop. 1930, 23,226.

COHORT, a unit of the Roman army. It constituted a 10th part of a legion and was composed of about 600 men, varying in size with that of the legion. Among the auxiliary troops, it was made up of between 500 and 1,000 men.

COIMBATORE, a city and district in the Madras Presidency, British India. Situated on the Noyil River and served by the South Indian Railway, Coimbatore is built on the slopes of Nilgiri Hills, 1,348 ft. above sea level. It is the district's most important industrial town, producing leather, cotton goods, coffee, sugar, fertilizers and saltpeter. The district of Coimbatore, a British possession since 1799, consists chiefly of plains enclosed on three sides by mountains, the highest of which are the Anamalai Hills, rising to 9,000 ft. The territory is traversed by many rivers, principally the Noyil, Cauvery, Bhavani and Amravati. Rice, millets, cotton, oilseeds, tobacco, silk and timber are the chief products. Area 7,225 sq. mi. Pop. 1921, city, 65,788; district, 2,219,848.

COIMBRA, capital of a district of the same name in Portugal, situated on a hill which overlooks the Mondego River. It is a picturesque old city with an ancient massive cathedral in 12th-century Romanesque style and a 16th-century later-Renaissance cathedral. It is the seat of a bishopric and famed for its university. The town has trade and industries. Its numerous monasteries and nunneries are in almost complete ruin but the Quinta das Lagrimas, where Inez de Castro was murdered, still stands. The Roman *Conimbriga*, Coimbra was taken from the Moors in 1064 and was the residence of the Portuguese kings from 1139 to 1383. It suffered great destruction by the earthquake of 1755. Pop. 1931, 27,333.

COIMBRA, UNIVERSITY OF, the national Portuguese university, at Coimbra, Portugal. It was founded by King Diniz at Lisbon in 1290-91, but was moved to Coimbra in 1308. The university, which numbers the poet, Camoens, among its students, was reconstituted in 1772. It has faculties of law, medicine, mathematics and philosophy. Its students, numbering about 1,400, preserve the medieval academic dress and various medieval customs. In 1931 the chancellor was Domingoes Fezas Vital.

COINAGE, the act of converting various metals into the coin money, or currency, of a nation. The word is derived from the Latin *cuneus*, meaning a wedge, which was the shape of the early dies used for coining metals in the Greek states (see NUMISMATICS). In modern society coins are relatively less important than they were before the creation of a credit structure which made BANK NOTES and CHECKS both practical and preferable for financial transactions in excess of a nominal sum. Nevertheless coins are

necessary for the multiplicity of small financial transactions in everyday life. Thus the regular minting of coins, together with the withdrawal of worn coins from public circulation, is one of the important functions of all governments. The coinage of metals is a fairly complicated operation. A bank note is merely a promissory note, and its mechanical production makes demand chiefly upon the engraver. Coins, on the other hand, must contain intrinsically their given value; a dime, for example, is legally restricted to a silver fineness of 900 thousandths, to which must be added a copper alloy to bring the coin up to its prescribed weight of 384 grams. A fine ounce means an ounce of pure gold, the value of which is constant at \$20.67183462. The assaying of the copper, silver, and gold is an operation requiring the maximum precision, since an insufficiency of basic metal will obviously result in coinage depreciation. It may be pointed out that such depreciation was common at various times to all European states, whose rulers, when lacking funds for national projects, resorted to reminting their coinage at a reduced ratio of gold or silver; exposure of such crude methods of raising funds inevitably depreciated the value of the coins in question.

United States Coinage. In the main, coins are similarly minted throughout the world. The almost universal acceptance of gold and silver as the monetary standards has been the chief factor in the relative standardization of coinage production. In the United States, government mints are located at Philadelphia, San Francisco and Denver, while assay offices, established chiefly as agencies for the purchase of gold and silver, are maintained at Seattle, Boise, Helena, Salt Lake City, New Orleans, Carson City, and Deadwood.

Modern coinage, as distinct from the medieval practice of striking coins by hand between two engraved dies, consists of eleven operations: first, reduction of the metal at the assay office to coinage homogeneity; second, the metal is melted and cast in a bar, from which clips weighing from 18 to 20 one-hundredths of an ounce are taken from either end of the bar; third, these clips are separately assayed to determine the average consistency of the bar; fourth, the bars are sent to the refinery where they are reduced to melts weighing 3,000 ounces, which are 900 parts fine (the standard fineness of both gold and silver in the United States, the remaining 100 parts being retained by the government to defray costs of minting); fifth, the melts of basic metal and copper alloy are cast into ingots of convenient size for conversion into coins, and reassayed; sixth, the ingots are broken down into coin-strips of a prescribed thickness; seventh, the strips are fed to a cutting machine, in which two carbon-steel dies punch out the blank coins, 100 a minute; eighth, the coins are examined for imperfections and weighed; ninth, the coins are milled by a machine, raising the edge of the blanks; tenth, the coins are annealed by gas-furnace, washed in a dilute sulphuric acid bath;

eleventh, the coins are fed to a coining press, a hydraulic machine capable of stamping its imprint on coins at a pressure ranging from 300 to 1100 tons.

Large coins are struck off at a rate of 80 to 90 a minute; dimes pass from the presses at the rate of 100 to 120 a minute. Standard gold coins, up to \$20, in the United States weigh 25.8 grains to the dollar; silver dollars weigh 412.5 grains, minted at a gold ratio of 15.988 to 1; the five cent nickel weighs 77.16 grains, and is composed of 75% copper, 25% nickel; the one cent piece weighs 48 grains, composed of 95% copper, 5% tin and zinc. The United States Mint was established by Congress in 1792, and the first coins produced during the following year. The gold double eagle, \$20, was first minted at Philadelphia in 1849; the first eagle, \$10, in 1795; the first half-eagle, \$5, in 1795, and quarter eagle, \$2.50, in 1796; first silver dollar in 1794; half-dollar in 1794, quarter-dollar in 1796, first dime in 1796, first silver half-dime in 1792, first nickel five-cent piece in 1866, first one-cent bronze piece in 1864, and first copper cent in 1787. The first Lincoln penny was minted in 1909. *See also DECIMAL COINAGE.*

COKE, SIR EDWARD (1552-1634), English lawyer and jurist, was born at Mileham, Norfolk, Feb. 1, 1552. He attended Trinity College, Cambridge, and became a member of the bar in 1578. From 1592-93 he served as speaker of the House of Commons and defeated Bacon for the attorney-generalship which he held from 1593-94. He was appointed Chief Justice of the Common Pleas Court in 1600 and Chief Justice of the King's Bench in 1613. Among the notable cases which Coke prosecuted are those of Essex and Southampton in 1601, Sir Walter RALEIGH in 1603, and two years later Guy FAWKES and other conspirators in the Gunpowder Plot. Due to the conflict between James I and Coke on questions of royal prerogative in matters of court jurisdiction, he was removed from the bench, Nov. 15, 1616. In 1618 he was made a member of the privy council but in 1621 again met with royal disfavor because of his opposition to Spanish marriage proposals and spent nine months in the Tower because of his activities. He died at Stoke Poges, Sept. 3, 1634.

COKE, the cellular, solid residue obtained when COAL is strongly heated, out of contact with air, in retorts or ovens. It consists essentially of carbon and the ash-forming mineral matter of the original coal, together with a total of from 3 to 4% of residual hydrogen, oxygen, nitrogen and sulphur.

Coke is used mainly as a metallurgical fuel and reducing agent, in blast furnaces, and foundry cupolas, in the manufacture and melting of iron, steel, copper and other metals. It is used also in the manufacture of WATER GAS and PRODUCER GAS.

In recent years, the use of coke as a smokeless domestic fuel has been growing rapidly. Public utility gas companies in the larger cities are replacing the small retort gas plants with modern by-product coke ovens.

The coal used is carefully selected with a view to producing a high grade, smokeless domestic fuel, low in ash and free from clinker-forming tendencies.

Metallurgical coke should be hard, blocky in structure and should not contain more than 1.0 or 1.25% sulphur.

COKE INDUSTRY, UNITED STATES. This industry comprises establishments devoted primarily to the production of coke by the distillation of coal, either in "by-products" ovens or in "beehive" ovens. During the decade 1919-29 the output of coke from by-products ovens, which save the valuable volatile constituents of the coal, increased from 64.5% to 95.5% of the total product. The accompanying table gives important statistics concerning the manufacture of coke, exclusive of gas-house coke.

COKE MANUFACTURE, U.S., 1929

Division	No Estab- lishments	Wage Earners	Wages \$	Value of Products \$
United States	153	20,552	33,389,425	416,348,458
LEADING STATES				
Pennsylvania	69	5,836	9,372,943	115,345,477
Ohio	16	2,967	5,462,549	61,884,849
Indiana	4	1,601	2,745,824	53,261,243
Illinois	6	1,723	2,698,042	34,305,080
New York	4	1,019	1,841,848	28,058,895
Alabama	8	1,606	2,219,825	24,937,794

Petroleum coke and pitch coke are made by similar carbonization processes from petroleum residue and pitch. For *production of coke* and its by-products, see CARBONIZATION. See also COAL, COKING.

A. C. F.

COLA (*Cola acuminata*), a tree of the sterculia family, closely allied to the cacao native to west Africa and extensively cultivated in South America and other tropical countries for its nutlike fruit. The tree grows about 40 ft. high, bearing leathery pointed leaves; small, yellow, purple-spotted flowers, and large, podlike fruits. These contain brownish, bitter seeds, which are the cola nuts or goora nuts of commerce, about the size of horse-chestnuts. The kernels, containing about twice as much caffeine as coffee, are used in making stimulating beverages and in medicine.

COLBERT, JEAN BAPTISTE (1619-83), French statesman, was born at Rheims on Aug. 29, 1619. Before his 20th birthday Colbert was serving in the war office, and became private secretary to the minister of war. When Mazarin was forced from Paris in 1651, Colbert acted as his informant on affairs under the Condé government. On Mazarin's return Colbert was awarded with honors and a place of power. Under Louis XIV, after the death of Mazarin, Colbert was the most powerful man in France. In 1665 he became comptroller general of finances, taking the purging of the financial department as his project. In order to stabilize finances he increased revenues, revised the tariff, furthered industry and trade, and by subsidies and navigation laws built up

the mercantile marine. He also imposed strict regulations on industry and improved roads and canals, but injured agriculture. With an apparently limitless supply of energy, he bettered the judicial procedure, acted as the sponsor for public buildings and art and science academies, and provided pensions for prominent literary figures. Supplanted in the favor of the king by Louvois, Colbert died on Sept. 6, 1683.

COLBURN, WARREN (1793-1883), American mathematician and educator, was born at Dedham, Mass., Mar. 1, 1793. In 1820 he was graduated from Harvard and opened a private school in Boston. The next year he published *First Lessons in Mental Arithmetic*, which was a popular school text for over 50 years. He also published other books on arithmetic and algebra and prepared a series of readers. Colburn was one of the founders of the American Institute of Instruction. He died at Lowell, Mass., Sept. 13, 1883.

COLBY COLLEGE. See WATERTOWN.

COLCHESTER, a river port and municipal borough of Essex, England, situated on the Colne 12 mi. from the sea, 52 mi. northeast of London. Traditionally the capital of Cymbeline who probably was the prototype of the city's eponymous patron Old King Cole, the city was originally established by Claudius as the first Roman colony in England. Twice destroyed, once by Boadicea and again by Danes in the 9th century, it was finally rebuilt by Alfred the Great. Parts of the Roman wall survive, and the environs are rich in Roman antiquities. The remains of the early 12th century St. Botolph's priory are of Roman brick, and the restored gateway, all that remains of a Benedictine monastery, about c. 1096, is also of Roman material. The Church of Holy Trinity with an apparently Saxon tower, and the ruined Norman castle situated in what is now a public park and having the largest keep in England, both incorporate Roman material. Modern Colchester is spacious and well-planned, with a barracks to the south. As in ancient times it is famed for its oysters grown at the mouth of the Colne. There are extensive corn and cattle marts and smaller, independent industries. Pop. 1921, 43,393; 1931, 48,607.

COLCHICUM, a genus of small herbs of the lily family, comprising some 30 species native to the Old World. They are stemless plants, rising from corms, with mostly narrow leaves and crocus-like flowers. The meadow saffron or "autumn crocus" (*C. autumnale*), an acrid-poisonous species with showy purple flowers 3 to 4 in. across, is often grown for ornament. The roots (corms) and seeds yield the powerful alkaloid colchicine used in medicine.

COLCHIS or **COLCHOS**, in Greek mythology, a land of sorcery, the home of MEDBA and the Golden Fleece. It was an ancient country on the shores of the Black Sea, south of the Caucasus and north of Armenia, and part of Pontus. Its first settlers were of various tribes. Later, Milesians colonized it.

COLD, COMMON, a condition characterized by a free discharge of fluid from the nose. When the body discharges fluid from any tissue, the reaction

is a protective one. The fluid serves, first of all, to wash away infectious and toxic material; second, to bring to the infected spot the material from the blood which attacks the germs.

If the cold does not promptly improve, the secretion stops and the nose becomes, for a while, quite dry. The organisms do not live in a dry state and tend to die on the surface of the mucous membranes which then secrete fluid to remove the infectious material. Not infrequently the cold is not limited to the nose, but the infection and inflammation of the membranes extends to the lining of the sinuses, the large cavities adjacent to the nose cavity, which serve to give resonance to the voice and to warm the air passing into the lungs and for other purposes.

A common cold is not like other infectious diseases, which occur once and then do not usually appear in the life of the individual. One may have a cold again and again for the simple reason that the germs which cause colds may be taken in with the air or on the hands or in various other ways and set up infection whenever the mucous membranes are lowered in their resistance. The body does not build up permanent resistance to colds. Hence, most physicians recommend, as the one best method for preventing colds, that the body be kept in as good a condition as possible. This is done by proper food, the proper amount of rest, exercise and fresh air.

In many instances the nose is so constructed that it is not possible to breathe easily through both sides; the air currents do not circulate properly, and the obstruction prevents the discharge of material from the nose. In such instances it may be necessary to open the breathing space by various methods of lessening the size of the structures within the nose, by shrinking the membranes or by changes in the septum.

The tissues of the human body tend to self-regulation. However, they respond readily to abnormal conditions and if they are to regulate themselves well, they must be given a fair opportunity. In many instances modern surgery is physiologic surgery. It restores the normal conditions under which tissues can function efficiently. *See also* LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE. M.F.

COLD CREAM. *See* FACE PREPARATIONS.

COLD HARBOR, BATTLE OF, June 1-3, 1864, in the CIVIL WAR, two disastrous assaults of the Union army, directed by Gen. Grant, upon Gen. Lee's entrenched Confederates. After the BATTLE OF SPOTSYLVANIA Lee again blocked Grant's line of march, at Cold Harbor, Va. Grant, unwisely choosing not to maneuver, ordered a direct assault on June 1. That being unsuccessful, on the 3rd he ordered another, hoping to crush the Confederate defense by sheer momentum. The battle was brief and disastrous; 6,000 Federal troops were left dead or wounded on the field, while the Confederate losses were insignificant.

COLD SORES. *See* HERPES.

COLD STORAGE is used to delay the natural processes of decay by keeping the temperature as

low as possible without injuring the commodity. The regulating of humidity is also important. Eggs are cold stored during the early spring for retail in the fall; fruits and vegetables are cold stored at the time of their harvest; and meats are chilled to a point where they can be held a few weeks or more until disposed of through the retail trade. The recent development of quick freezing at -50°F . promises to insure better quality meats than does the regular method of cold storage, especially as the meat may be retailed in a frozen state. Also some of the soft fruits and berries can be kept in excellent flavor indefinitely when frozen. Cold storage is also used to protect fur during the warmer seasons. *See also* MECHANICAL REFRIGERATION; REFRIGERATION AND ICE MANUFACTURE.

COLDWATER, a city in southern Michigan, the county seat of Branch Co., 110 mi. southwest of Detroit. Bus lines and the New York Central Railroad afford transportation. Coldwater is a delightful summer resort, surrounded by many small lakes which offer excellent fishing. The city is a trade and manufacturing center, having Portland cement plants, furnace, marine engine, and gray iron casting shops, also lawn furniture, sled, clothing and shoe factories. Coldwater was founded in 1831, but was called Lyons until 1833. It was incorporated as a city in 1861. Pop. 1920, 6,114; 1930, 6,735.

COLD WAVE, a term first applied to describe the southward progress of large masses of cold, dry air flowing from high-pressure areas in Canada toward the warmer, low-pressure areas above the Gulf of Mexico. Their southward motion is so regular that their advance can be predicted with comparative certainty. The actual drop in temperature may often reach 20° to 30° , but the duration of the wave is seldom more than a few days.

COLE, THOMAS (1801-48), American painter, was born at Bolton, Lancashire, England, Feb. 1, 1801. His family came to America in 1819 and settled at Steubenville, O., where Cole learned the fundamentals of painting from an artist named Stein. Following in his master's footsteps, he became an itinerant artist, but met with small success until some canvases attracted the attention of John Trumbull. Although Cole made his reputation by his allegorical pieces, such as *The Voyage of Life* and the series entitled *The Course of Empire*, the latter in the New York Historical Society, his importance to American painting lies in his influence upon the early landscape school, of which he was one of the founders. (*See* AMERICAN SCHOOL OF LANDSCAPE PAINTING.) His virtues in this field were those of sincerity and an honest effort at realism; his faults were the inevitable result of an inadequate technique. Cole died at Catskill, N.Y., Feb. 11, 1848.

COLE, TIMOTHY (1852-1931), American wood-engraver, was born at London, April 6, 1852. In 1875 Cole began to work for *Scribner's Magazine*, then *Century Magazine*. His engravings attracted critical notice and he was commissioned to make engravings

in Europe after the old masters. His Dutch and Flemish and other series are of outstanding importance in the art of engraving. Cole died on May 17, 1931.

COLEMAN, GLENN O. (1887-1932), American painter, was born at Springfield, O., in 1887. He came to New York in 1905 and studied with Robert Henri, under whose influence he turned to the life about him for subject-matter. In his earlier work he was fascinated by the human drama of the streets and set down in a series of drawings a vivid account of the teeming, colorful life of New York. Years later he translated those drawings into lithographs which are a distinctive contribution to American graphic art. Coleman's vision was expressed in highly personal terms, his style formed naturally from the elements of his own experience. An individualist, he was only slightly influenced by tradition or contemporaries; the entire body of his work exists as a complete expression of the whole man. Among his most important paintings are *Minetta Lane*, Musée du Luxembourg; *Speak easy*, Metropolitan Museum; *Fort Lee Ferry*, Brooklyn Museum; and *The Arch*, Whitney Museum of American Art, New York. Coleman died at Long Beach, N. Y., May 8, 1932. H. M.

COLEMAN, a city and the county seat of Coleman Co. in central Texas, situated about 175 mi. southwest of Fort Worth. The Gulf, Colorado and Santa Fe Railroad serves the city. The chief crop of the vicinity is cotton. The district also produces oil and natural gas. Coleman was incorporated in 1892. Pop. 1920, 2,868; 1930, 6,078.

COLEMANITE, the most important source of BORAX, occurring principally as milky white nodules and layers in clay beds. It is deposited by precipitation from evaporating marshes and lakes, sometimes in rocks by circulating waters. Colemanite is a hydrous calcium borate.

COLENZO, BATTLE OF, Dec. 15, 1899, a battle fought at the village of Colenso, on the Tugela River in Natal, South Africa, between the Boers, under Louis Botha, and the British, commanded by Gen. Buller. There were about 20,000 men on each side. The English, being defeated, thenceforth made radical changes in their military tactics.

COLEOPTERA, the scientific name for an order of insects known popularly as beetles. There are some 180,000 species, varying in size from creatures that are barely visible, to others six inches long. They have horny fore-wings that form a sort of armor for their backs; under these are folded their membranous hind-wings, used in flight. Some species have no hind-wings and cannot fly. Their mouths are adapted for biting. Among them are vegetarians, carnivores, scavengers and parasites.

COLERIDGE, HARTLEY (1796-1849), English writer, was born at Bristol, Sept. 19, 1796. He was the eldest son of SAMUEL TAYLOR COLERIDGE, and was educated at Oxford. Though weakness of will hampered his genius, he wrote several exquisite sonnets. His fame rests chiefly on these, the *Prometheus*, and his edition of Massinger and Ford. He died Jan. 6, 1849.

COLERIDGE, SAMUEL TAYLOR (1772-1834), English poet and philosopher, was born at his father's vicarage, Ottery St. Mary's, Devonshire, in 1772. On his father's death he was schooled at Christ's Hospital, where he showed great mental precocity, which CHARLES LAMB has described. He left Cambridge in 1794 without a degree and made the acquaintance of the Wordsworths, who fell at once under his fascination, and moved into his neighborhood. (See WORDSWORTH, WILLIAM.) They proposed a joint volume of poetry in which Coleridge would show the supernatural convincingly, and Wordsworth the power of imagination over the commonplace. The result was *Lyrical Ballads*, including the ANCIENT MARINER, 1798. Through the gift of an annuity, Coleridge was enabled to go with the Wordsworths to Germany. He learnt German in 14 months and translated Schiller's *Wallenstein* in six weeks. Returning to England he wrote many articles for the *Morning Post*. His increasing physical suffering caused him to fall completely under the opium habit. But it is not perhaps possible to state how far the drug was responsible for the mental decay he described so pathetically in his letters. At the time of the *Ode to Dejection* the spark had almost expired. Byron was instrumental in having Coleridge's *Remorse* produced in 1813, when it had great success. In an effort to escape his habit he entered the Gilman family, whose home it became a privilege to enter, so great was the lure of Coleridge. There he published *Christabel*, his *Lay Sermons*, *Aids to Reflection* and *Church and State*. He died July 25, 1834.

Coleridge lacked the sustained power to create a philosophical system, but he breathed a vital spirit into German metaphysics. He gave England a higher critical standard, and liberalized religious views. As a poet he is alone in his own mystical regions. See also ENGLISH LITERATURE.

BIBLIOGRAPHY.—S. T. Coleridge, *Biographia Literaria*, 1847, numerous later editions; H. Fausset, *Samuel Taylor Coleridge*, 1926; J. L. Lowes, *The Road to Xanadu*, 1927.

COLERIDGE-TAYLOR, SAMUEL (1875-1912), Negro composer, was born at London, England, Aug. 15, 1875, where his father, a native of Sierra Leone, practised medicine. At 15 he won a scholarship at the Royal College of Music. His best known work is the cantata *Hiawatha*. He wrote chamber music, a violin concerto, songs and piano pieces. He died at Croydon, Sept. 1, 1912.

COLET, JOHN (c. 1467-1519), English educator and theologian, was born probably at London about 1467. He held several rectories from 1485-94 and traveled in Paris and Italy 1493-96. The following three years he lectured on the New Testament at Oxford and there met Erasmus who was greatly influenced by his teachings. In 1505 he was made dean of Saint Paul's in London, and four years later, on receiving a large inheritance from his father, reestablished Saint Paul's School. For his liberal views and attacks on corruption in the Church, Colet has frequently been credited with paving the way for The

Reformation, though the facts would not seem to substantiate this view. He died at or near London, Sept. 16, 1519.

See S. Knight, *Life of Dr. John Colet*, 1923; F. Seebohm, *Oxford Reformers*, 1914.

COLET, MADAME LOUISE (1810-76), French poet and novelist, was born at Aix, Sept. 15, 1810. With her husband, Hippolyté Colet, a composer of music, she went to Paris in 1835, where she was associated with a group of celebrated writers, including Abel Villemain, GUSTAVE FLAUBERT and Victor Cousin. Her novel, *Lui: roman contemporain*, based on her liaison with Flaubert, is considered particularly significant among her writings, but more outstanding in its achievement was the publication in 1847, in defiance of legal injunction, of the correspondence of MADAME RÉCAMIER with Benjamin Constant. In 1849 her salon became the successor of the scintillating Récamier salon. Madame Colet died at Paris, Mar. 8, 1876.

COLEUS, a genus of plants of the mint family, comprising about 90 species of herbs or small shrubs, native chiefly to tropical regions in the Old World, several of which are cultivated for their variegated foliage. The common garden coleus (*C. Blumei*), a soft, slightly branched perennial herb or subshrub, bears small, toothed leaves, variously colored with yellow, dull red and purple. A hardy form (*var. Verschaffeltii*), now widely grown, is profusely branched and bears more brilliantly colored foliage.

COLFAX, SCHUYLER (1823-85), American statesman, was born in New York City, Mar. 23, 1823. In 1836 his mother and stepfather moved to Indiana. In 1841 Colfax obtained work as county deputy auditor at South Bend. He studied law in Indiana and in 1845 bought an interest in the *South Bend Register*, which he made the chief Whig organ in northern Indiana. He joined the Republican party in 1854, and the same year was elected to the national House of Representatives, where he served until 1869, being Speaker from 1863 on. Largely because of his resolute attitude toward the Confederacy and slavery, he was awarded the vice-presidential nomination at the Republican convention of 1868, and was elected with Grant. In 1871, while Vice-President, he declined to become Secretary of State. He suffered in the charges of wholesale corruption hurled at the administration over the Crédit Mobilier scandal, 1873, and though the accusations were never substantiated, he was forced to retire from active politics. He died at Mankato, Minn., Jan. 13, 1885.

COLGATE UNIVERSITY, at Hamilton, N.Y., an institution for men chartered in 1819. In 1890 the name was changed from Madison University to Colgate University. Traditionally Baptist, it is undenominational. The Theological Seminary is under the supervision of the Baptist Education Society of the State of New York. The university had productive funds in 1931 of \$6,109,667. The library of 108,000 volumes contains the Samuel Colgate Baptist Historical Collection. In 1931-32 there were 1,005

students, and a faculty of 93 headed by Pres. GEORGE BARTON CUTTEN.

COLIC, acute pain within the abdomen, of whatever cause. More specifically it is applied to a condition in infants characterized by pain in the abdomen, probably produced by contraction of the intestines. During an attack of colic the baby screams and draws up his legs; the muscles in the wall of the abdomen become tense. The attacks are usually of short duration and, after the passage of gas, the pain usually disappears quickly. The treatment of the colic consists in applying warmth to the abdomen and in giving an enema of warm water.

The exact cause for infantile colic is not known. It is possible that faulty diet and constipation are factors in producing it. However, the diet should not be changed markedly merely because the baby has colic.

Common types of colic in the adult are biliary colic due to the passage of gall-stones along the bile duct; lead or painter's colic due to lead poisoning; and renal colic as a result of the passage of a stone from the kidney, through the ureter, to the bladder. W.I.F.

COLICROOT, a small perennial herb (*Aletris farinosa*) of the lily family called also ague grass and blazing star. It grows in dry sandy soil from Maine to Minnesota and southward to Florida and Arkansas. The plant bears spreading, lance-shaped, basal leaves and a slender, grooved flower-stalk terminating in a narrow spike-like cluster of yellowish-green flowers. One of the most intense bitters known, used medicinally as a tonic and stomachic, is obtained from the dried, fibrous roots, which should be collected in autumn. Other species of *Aletris* and various unrelated plants, reputed to possess similar properties, are also known as colicroot.

COLIGNY, GASPARD DECHALILLOIN, COMTE (1519-72), admiral of France and Huguenot leader, was born at Chatillon-sur-Loing on Feb. 16, 1519. At the age of 22 he went to the French court, and became a friend of Francis of Guise, afterward his greatest enemy. He was in the forces of the Duke of Enghien in Italy in 1544, being knighted during the campaign. He was made colonel general in 1547 and admiral in 1552. A year or two before 1560 Coligny became a Huguenot, and thenceforward schemed for the safety of the Protestants against the Guises. He led the Huguenots in the civil wars which began in 1562, and achieved the peace of St. Germain as the chief leader of his party since the death of Condé in 1569. Because of his growing favor with Charles II, Catherine de Medici, the queen-mother, planned the massacre of St. Bartholomew's Day. On Aug. 24, 1572, after being wounded, he was attacked and slain in his house. His history of the civil war is supposed to have been burned by Catherine.

COLIMA, one of the smallest and most sparsely settled states of Mexico, situated on the southwest coast. It has an area of about 2,200 sq. mi. and rises from a low tropical coastal plain toward the two

mountains, El Volcan and El Nevado. The climate is semi-tropical throughout the state. There are valuable salt deposits along the coast, and although the methods of extraction are crude, the output is valued at about \$250,000 a year, and more than 5,000 men are employed. Almost every known variety of tropical fruit grows in the state, and its agricultural possibilities are almost unlimited. The capital is Colima; other important towns are Manzanillo, Cuyutlan, and Villa Alvarez. Pop. 1921, 91,749; 1930, 60,845.

COLIMA, a city in southwestern Mexico and capital of the state of the same name, situated on the Colima River, about 38 mi. from the Pacific Ocean, at an altitude of 1,500 ft. above sea level. The Mexican Central and Southern Pacific railroads afford transportation. About 35 mi. distant stands the noted Colima volcano. The city is the commercial center of a productive valley, watered by the Colima River, and has two electric light plants, several factories, a picturesque cathedral with double towers, and a street railway system. The suburban village of Alvarez is reached by street car. There is a marked contrast between the tropical aspect of the city and that of the snow-capped peaks in the distance. The view at night is inspiring. Because of

Colima has been one of the most troublesome of Mexican volcanoes. History mentions violent eruptions in 1575, 1611 and in 1806 when it produced a strong earthquake; and in 1808 and 1818 when it sent clouds of ashes as far as Guadalajara and San Luis Potosi. Since June 1869 it has been almost continuously in a disturbed state, but save for spectacular eruptions in 1903 and 1909 up to 1931 had not emitted molten lava. Inside the crater is a mass of hot lava from which clouds of steam and sulphur gases escape, sometimes reaching 1,000 ft. down the mountain side. At night this steam is colored with a beautiful fire glow. Because of its fine contour and its isolation from other peaks it is one of the most attractive features of Jalisco.

COLLAGEN, the parent substance of **GLUE** and **GELATINE**; it occurs in bones, hides, skins and sinews. Many books of reference perpetuate the error that glue is made from hoofs and horns, which consist mainly of keratin and yield *no* glue, though the bony support of horns (horn pith) and the bones and sinews in feet (e.g., calves' feet) contain collagen and yield gelatine or glue. Ossein is collagen made from bone. The manufacture of glue and gelatine may be epitomized thus:

RAW MATERIALS	PONE STOCK			HIDE AND SINEW STOCK	
TREATMENT	(Untreated)	Degreased with volatile solvents.	Degreased with volatile solvents. Acidulated to remove lime.	Limed to "plump" and to remove hair; then washed and acidulated to remove traces of lime.	Acidulated to "plump" or swell; then neutralized.
"COOKING" AT 150°-175° F.	The prepared and Swollen Collagen is hydrolyzed into Gelatine or Glue by heating in water, yielding a solution which may be concentrated by vacuum evaporators.				
"DRYING"	Spray or Drum Dried			Chilled into blocks, which are cut into sheets, then	Pearls formed in chilled non-aqueous liquid
				Dried on Nets	Dried
FINISHED PRODUCT	Sheets, broken flakes, powder, pearls, "noodles."				

J. A.

its isolated location, Colima has had small part in Mexican history, and has suffered little from revolutionary activities. It was founded about 1523. Pop. 1921, 28,326; 1930, 24,610.

COLIMA, VOLCAN DE, one of the most recently active volcanoes of Mexico. It is situated in the state of Jalisco about 50 mi. from the Pacific coast and rises to a height of 12,750 ft. The crater is almost circular with a diameter measuring one-third of a mile.

COLLECTIVE BARGAINING means negotiation of terms of employment between employers or associations of employers and groups of employees. It substitutes group action for individual action in negotiating terms of employment and in interpretation and enforcement of contracts. The controversy over collective as opposed to individual bargaining has been long and acrimonious. Group bargaining presupposes a surrender of certain individual rights

and subordination to the will of the group. Such limitation of freedom, it is argued, constitutes an infringement of FREEDOM OF CONTRACT and prevents the employer from buying his labor in the most advantageous market and from running his business as he sees fit. It prevents the worker from selling his labor under any conditions he may consider desirable. On the other hand, due to differences in economic advantage, bargaining power, experience and skill in contract making and knowledge of labor supply, the individual employee is at a serious disadvantage in bargaining with his employer.

Employees have insisted upon their right to bargain collectively—employers upon their right to refuse to do so. Many progressive employers now concede that although both parties may have the right, the issue resolves itself into a question of policy, whether more effective industrial organization and improved relationships will result from the adoption of collective bargaining methods. There are still some employers however, notably in the iron and steel industry, who still insist upon individual bargaining, to maintain which employees are sometimes required to sign promises not to join unions. (See LABOR ORGANIZATIONS.)

Granted that it is good policy to bargain collectively, with whom shall the employer bargain? Some employers grant their employees the privilege of bargaining collectively but refuse to permit representation in their negotiations by union officials or any one other than the employees of the plant or group of plants affected. Thus arises the controversy as to the right of employees to representatives of their own choosing. On this point certain employers object to bargaining through the trade union on the ground that trade union agents are not representatives of their employees and are not sufficiently acquainted with technical details of the business and the issues involved, but are primarily concerned with the success of the union they represent, rather than with that of the industry upon which the welfare of the employee depends. Employees on the other hand object to collective bargaining through employee representatives on the ground that such representatives are too dependent upon the employer and too much under his influence or too afraid of discharge, adequately to represent the workers.

Collective bargaining in its truest sense means bargaining between employers or groups of them and their employees as represented by their trade unions. The terms of the collective bargain usually relate to standards, such as rates of wages to be paid, hours and conditions under which the work shall be done, and usually, the period of time during which the agreement shall run. Such an agreement obligates the employer to provide such standards as long as he provides work, and the employee to accept the agreed standards as long as he works. The employer is not obligated to provide work, however, nor is the employee obliged to work.

Regarding such contracts the law is still in a plas-

tic state. Although not a true contract, the collective agreement has come to be somewhat more than a gentleman's agreement and to receive some protection and enforcement in courts of equity. In many foreign countries where the trade union and the collective agreement are much more generally recognized, legislation regarding them has been developed to a much greater degree.

American trade unions generally, fearing the effect of legislation upon their membership, have preferred to gain their objects through collective bargaining rather than legislation. P. F. B.

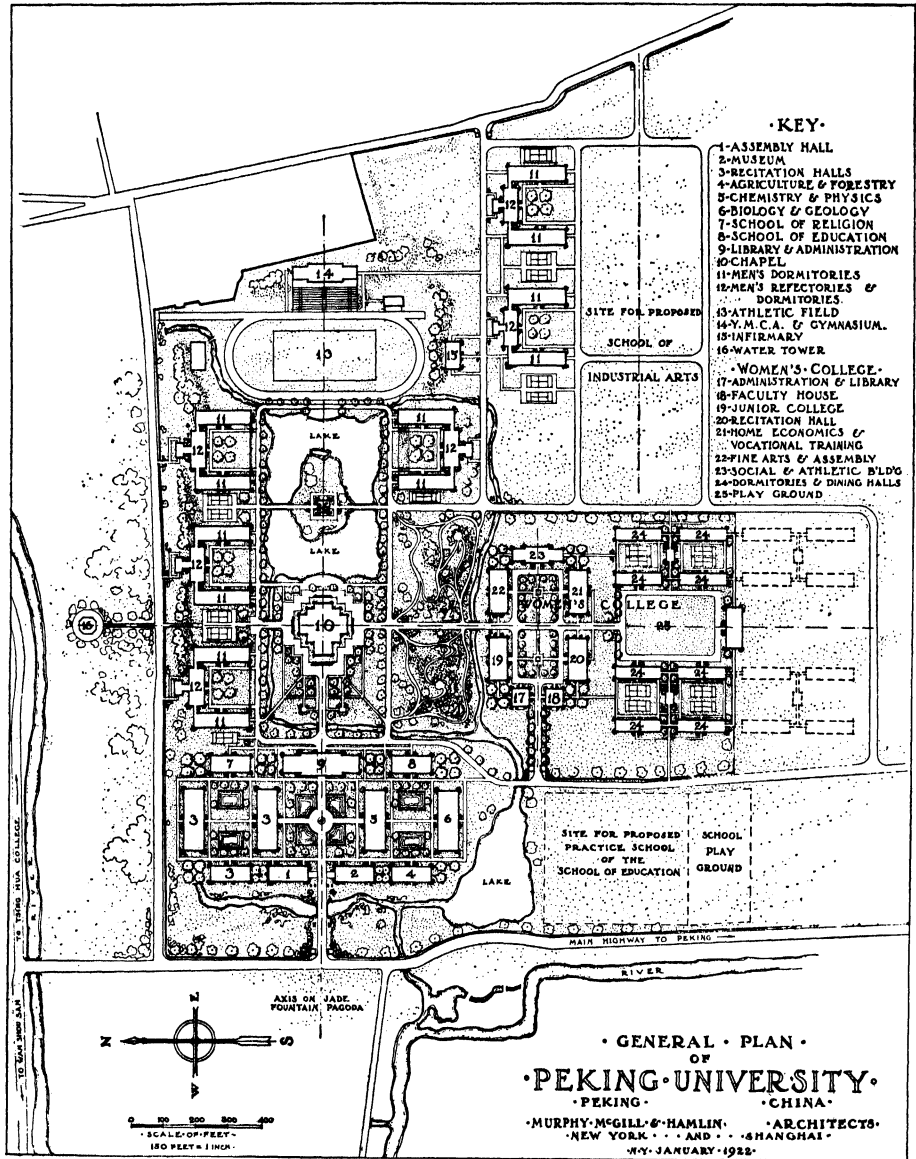
BIBLIOGRAPHY.—R. F. Hoxie, *Trade Unionism in the U. S.*, 1919; W. B. Catlin, *The Labor Problem*, 1926; W. G. Rice, in *Harvard Law Review*, Feb., 1931, *Collective Labor Agreements in American Law*.

COLLEGE ADMISSIONS, METHODS OF.

Completion of a four-year course in an approved secondary school or its equivalent is required for admission by all standard colleges or universities in the United States. While certificates of graduation from high schools are still accepted by many colleges, the growing tendency is to hold entrance examinations. Before the development of the four-year high school course, entrance was entirely by examination. In the early days these examinations were held at the individual colleges in which the students wished to matriculate, and some of the colleges still adhere to this practice. Beginning with 1901, however, the College Entrance Examination Board, made up of representatives of leading colleges and universities and secondary schools, has been holding entrance examinations at centers widely distributed over the United States. A growing number of the universities and colleges are cooperating with this Board and accepting students who have passed their examinations. (See EXAMINATIONS, COLLEGE ENTRANCE.)

In the last few years much stress has been laid on intelligence tests as an important indication of a student's probable success in his college work. A few colleges have used this test together with the student's school record in lieu of an entrance examination. The majority, however, while adopting some form of general intelligence test, as a partial diagnostic aid, have continued the use of examinations of the new or objective form as well as of the old or essay type.

COLLEGE ARCHITECTURE. The respect for knowledge and the desire to obtain it follow closely upon religion. The Church ministered to that desire and it created and fostered the early institutions of learning. Even universities granted charters by ruling princes were identified with the religious faiths of their founders. It is, therefore, not surprising to find these early institutions housed in religious buildings or in palaces donated by the sovereigns. This is especially the case in Europe. At Salamanca, for example, the cloisters of the cathedral were used as classrooms. At Breslau the university library and the museum are in an old Augustine abbey. The aula at Utrecht was originally the chapter house of the cathedral. At Leyden the first university building was a



Jacobin nunnery. At Bonn the university was originally the Electoral Palace.

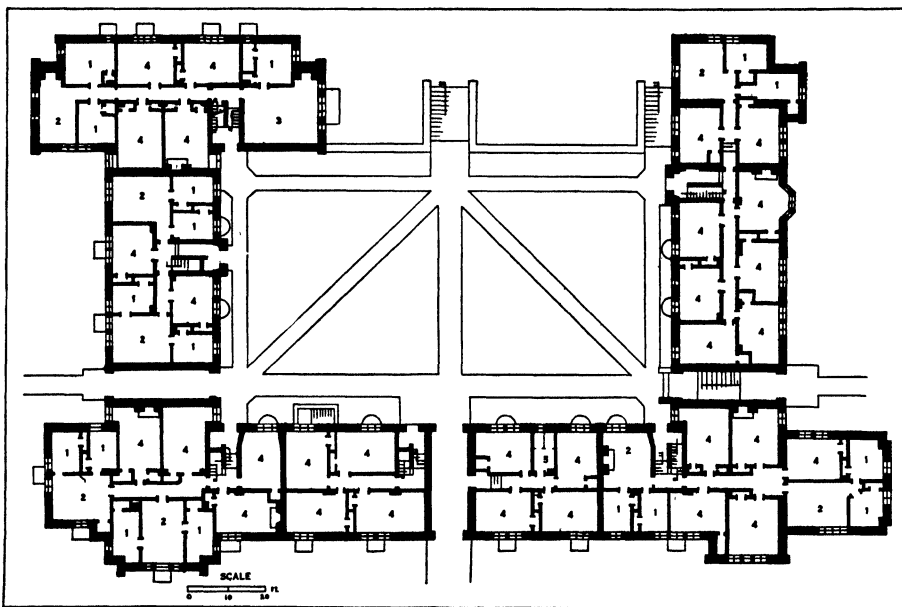
Manifestly these were improvised quarters. Though new buildings were erected as the universities grew,

the urban locations imposed constricted sites and the buildings were close together, commonly following the lines of ancient and rambling streets and enclosing courts, upon whose surrounding colonnades opened

the aulae, lecture rooms, libraries, museums, seminars, laboratories and administrative offices. The style of architecture was scarcely distinguished from the quasi-monumental buildings of the locality. Contrariwise the towns grew around the universities and confined them. Thus it is that in the majority of Continental cities the buildings of the universities are not self-evident; nor do they identify themselves as devoted to educational purposes alone. The university means to-day in many Continental towns but one building, and only infrequently does an expansive site bordering a square or park enable the university clearly to detach itself from its neighbors.

The three classes of universities that, by virtue of their physical aspects at least, distinguish themselves to English-speaking people are the Continental, the English and the American. The formality of the architecture of the first-named expresses the activities carried on within them, activities which are scholastic only, for the Continental universities do not provide living quarters for students. This is true also of the universities established for a democratic student body within the last century in the largest cities of England and Australia.

English Examples. The preeminent type of English university is found at Oxford and Cambridge.



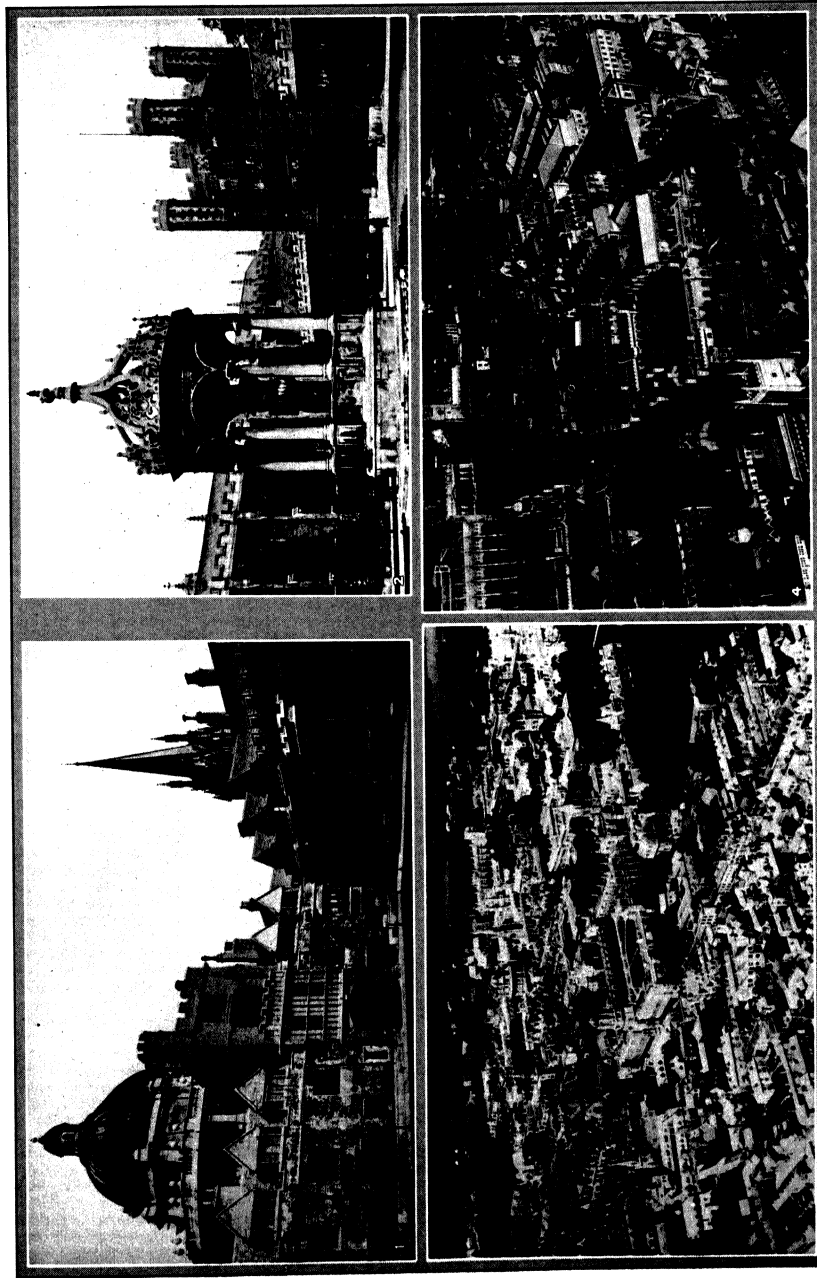
FROM CHARLES Z. KLAUDER AND HERBERT C. WISE, *COLLEGE ARCHITECTURE IN AMERICA*. CHARLES SCHIBNER & SONS

FIRST FLOOR PLAN OF PYNE HALL, PRINCETON UNIVERSITY, PRINCETON, NEW JERSEY. CHARLES Z. KLAUDER, ARCHITECT
1, Bedroom; 2, study; 3, professor's study; 4, study bedroom; 5, toilet

The University at Cairo resembles a mosque. At the Imperial University at Peking new buildings designed under Western influence take the place of the native one- or two-story structures built around small square courts, opening into each other through broad gateways and said to have been originally built as palaces. The 50 buildings of the modern University of Tokyo show the influence of German universities. Those of Calcutta, Bombay and Madras are of modern English architectural styles. University buildings in South America, outside the cities, are usually two stories in height; in cities, three and four. The exteriors are in the Renaissance style as taught at European architectural schools, notably that of Paris, and found in modern buildings of France and Spain.

There the students are required to reside; living quarters are as important as the facilities for study, worship and recreation. The buildings that came into existence at Oxford around the University Church of St. Mary and the schools were at first the halls which were scarcely more than inns or hostels for the students, i.e., rows of separate dwellings, each with its entrance on the side away from the street and each independent of its neighbor. Later the colleges were erected, each complete in itself with its own chapel, parlor, library, master's lodge and hall, common room, student lodging, dining hall or commons, kitchen and offices. The accommodations were increased by means of contriving rooms in the attics, by adding dormers and stories. These comparatively low buildings ex-

COLLEGE ARCHITECTURE

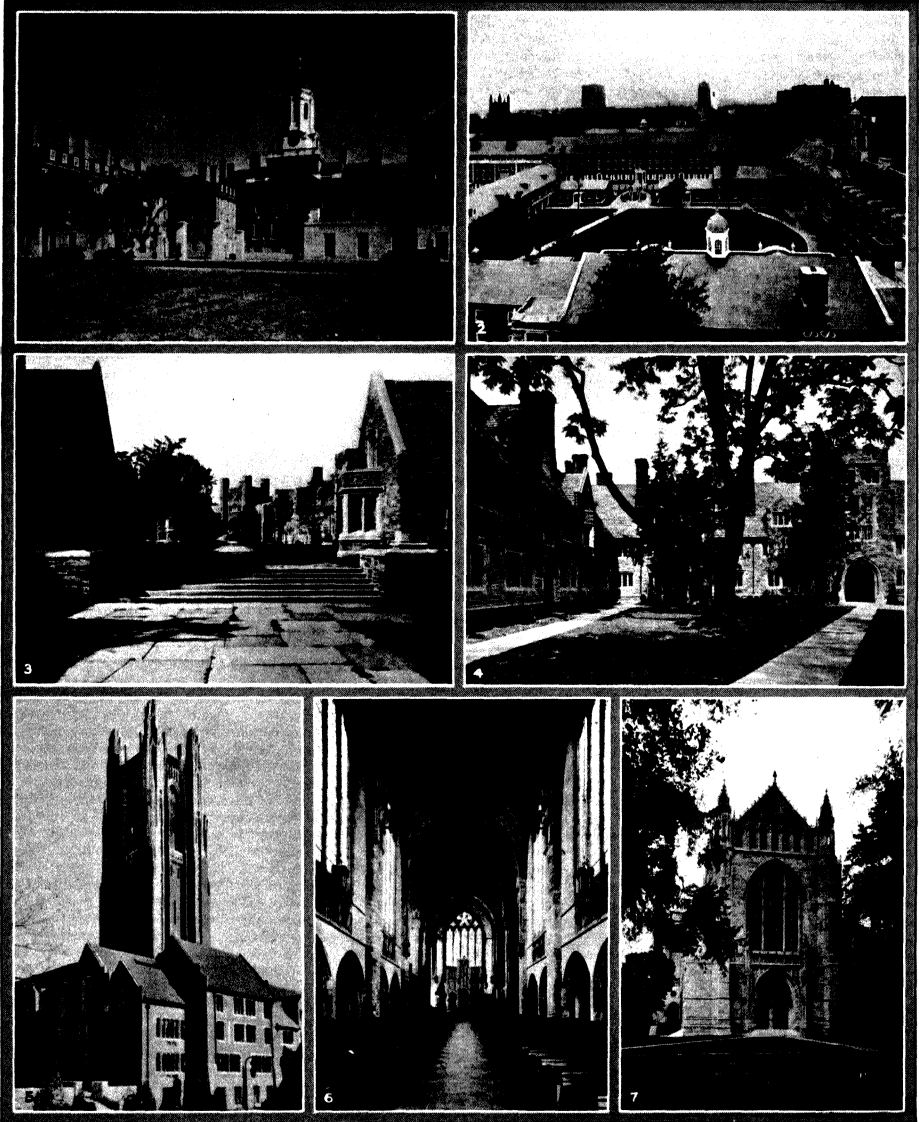


1. KEYSTONE VIEW CO. PHOTO. 2. BY BURTON HOLMES, FROM ERING GALLOWAY. 3. BY AEROFILMS, FROM ERING GALLOWAY. 4. ERING GALLOWAY

ENGLAND'S TWO GREAT UNIVERSITIES

1. The Quadrangle, Brasenose College, Oxford. The College was founded in 1509. 2. Court of Trinity College, Cambridge, with beautiful King's Gateway, dating from the times of Edward IV and Henry VIII, at the right. 3. Air view of the colleges and grounds of Oxford. 4. Cambridge, showing the University Press, Pembroke and Corpus Christi Colleges, and King's Parade.

COLLEGE ARCHITECTURE



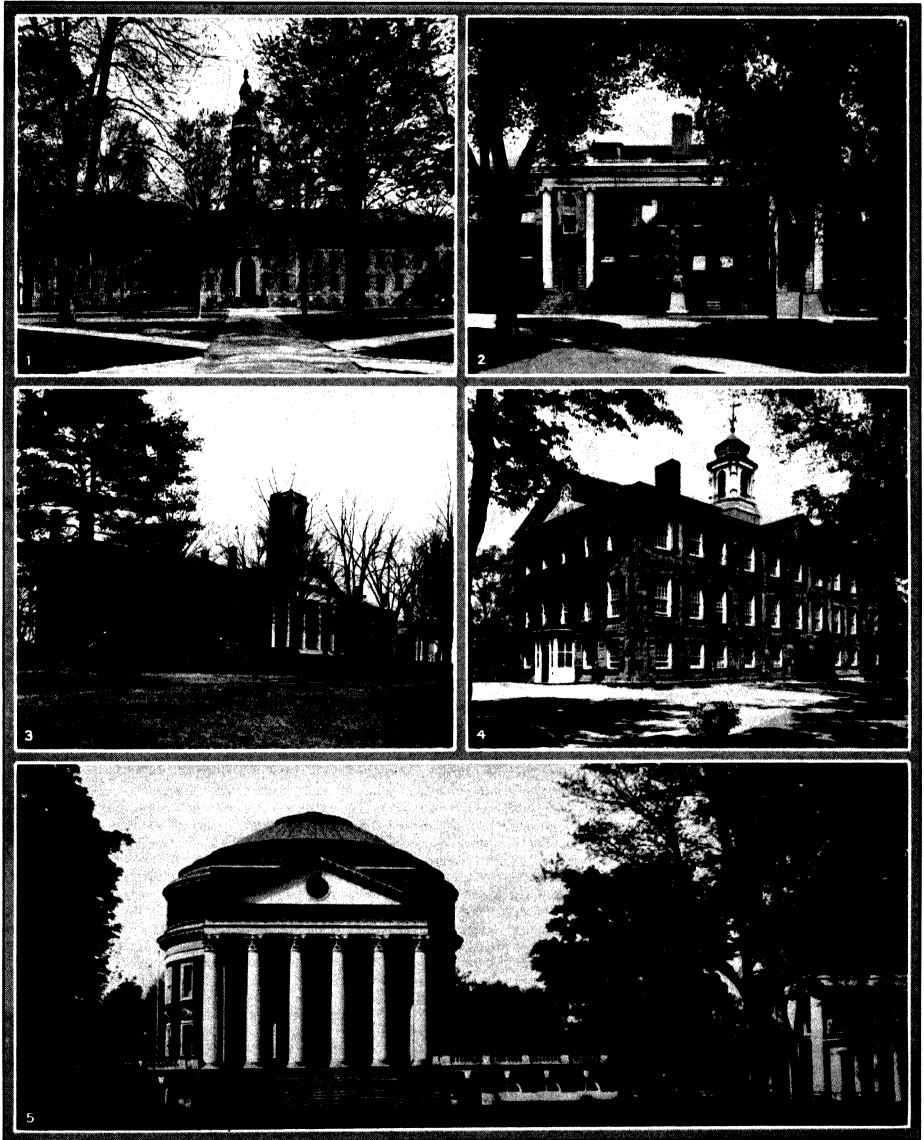
1. COURTESY HARVARD UNIVERSITY; 2. KEYSTONE VIEW CO. PHOTO; 3. 4. 7. COURTESY PRINCETON UNIVERSITY; 5. WELLESLEY COLLEGE

I. COLLEGE ARCHITECTURE IN THE UNITED STATES

1. Dunster House, one of the units of the Harvard House Plan, Harvard University, Cambridge, Mass. 2. Davenport College, first of the colleges of the Yale House Plan, Yale University, New Haven, Conn. 3. Main entrance of Princeton University, Princeton, N.J., with Blair Hall in the back-

ground. 4. Holder Hall, a dormitory, Princeton University. 5. Hetty H. R. Green Hall, administration building of Wellesley College, Wellesley, Mass. The Galen L. Stone Carillon Tower rises above it. 6. Chapel of the University of Chicago, Chicago, Ill. 7. Princeton University Chapel.

COLLEGE ARCHITECTURE



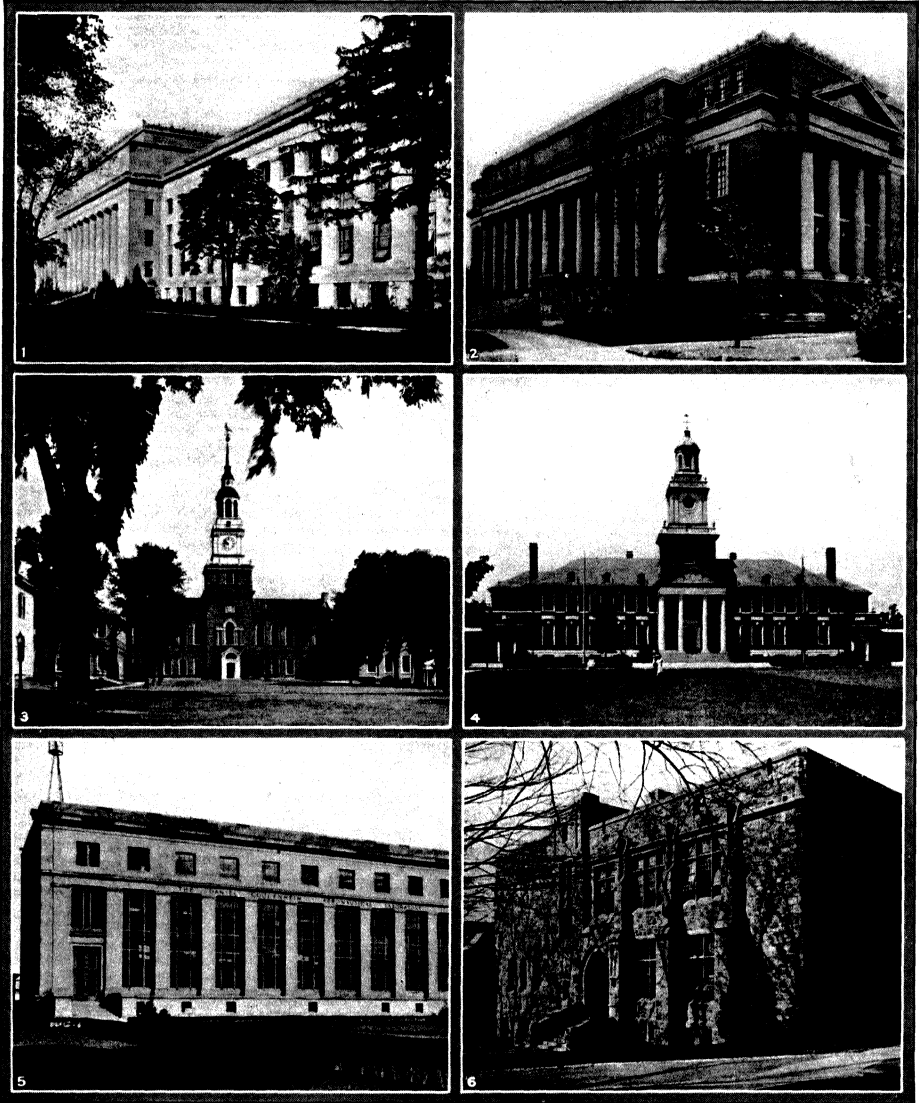
1. COURTESY PRINCETON UNIVERSITY; 2. FAY S. LINCOLN PHOTO; 3. COURTESY AMHERST COLLEGE; 4. RUTGERS UNIVERSITY; 5. EWING GALLOWAY PHOTO

II. COLLEGE ARCHITECTURE IN THE UNITED STATES

1. Nassau Hall, Princeton University, Princeton, N.J., completed 1756. 2. University Hall, administration building of Harvard University, Cambridge, Mass., 1815. Charles Bulfinch, Architect. 3. College Row, Amherst College,

Amherst, Mass. 4. Queen's Building, Rutgers University, New Brunswick, N.J., dating from 1808. John McComb, Architect. 5. Rotunda of the University of Virginia, Charlottesville, Va. Thomas Jefferson, Architect.

COLLEGE ARCHITECTURE



1. COURTESY UNIVERSITY OF MICHIGAN; 2. UNDERWOOD AND UNDERWOOD PHOTO; 3. PAUL J. WEBER PHOTO; 4. COURTESY JOHNS HOPKINS UNIVERSITY; 5. R. I. NESMITH AND ASSOCIATES PHOTO; 6. COURTESY T. F. HAMLIN, ESQ.

III. COLLEGE ARCHITECTURE: RECITATION AND ACADEMIC BUILDINGS

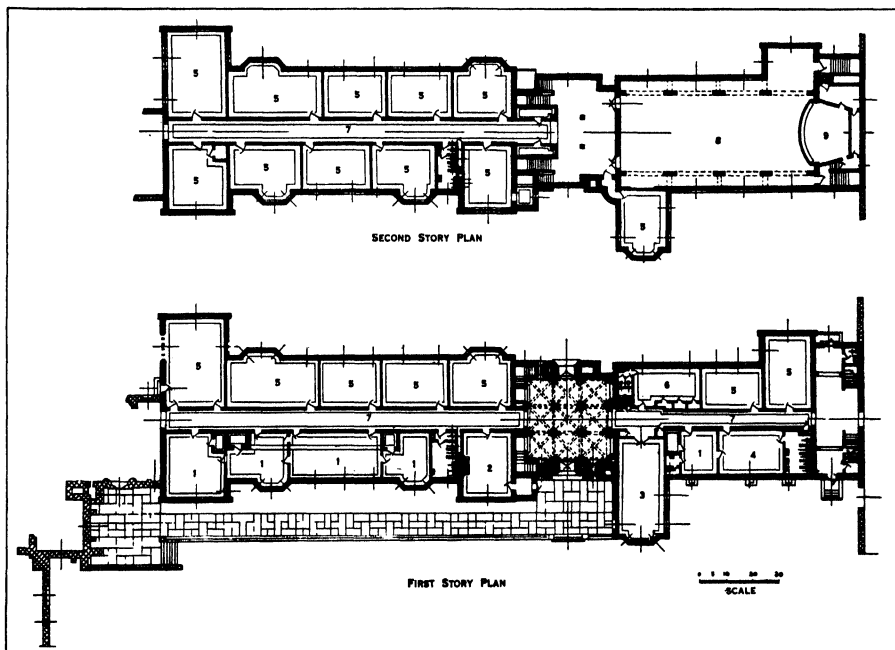
1. James B. Angell Hall, University of Michigan, Ann Arbor, Mich. Albert Kahn, Architect. 2. Widener Memorial Library, Harvard University, Cambridge, Mass. Horace Trumbauer, Architect. 3. Baker Memorial Library, Dartmouth College, Hanover, N.H. Larson and Wells, Architects. 4. Gilman Hall, Johns Hopkins University, Balti-

more, Md. Parker, Thomas and Rice, Architects. 5. Guggenheim Aeronautical Laboratory, Massachusetts Institute of Technology, Cambridge, Mass. Coolidge and Carlson, Architects. 6. Science Hall, College of New Rochelle, N.Y. McGill and Hamlin, Architects. The regularly-spaced windows are designed to light laboratory tables within.

tended horizontally enclosing a quadrangular sequestered space, or "quad," punctuated by entries at frequent intervals, each entry having a stairway and giving access to rooms upon the right and upon the left. Thus the entry has become the unit of student dormitories where the English system is followed. It is this punctuation into small units and the freedom of fenestration imposed by the yet smaller units of the individual rooms that characterize this English style of structure. The style may be termed Collegiate Gothic and defined as that architecture in which Gothic detail is applied to college and university

and Haight's buildings at Yale, 1893, there set in a predilection for the English Collegiate style further stimulated probably by Cobb's ambitious group for the University of Chicago, which was contemporaneous with Cope & Stewardson's work at Bryn Mawr and at Princeton. Designs in the same style for Washington University at St. Louis soon followed.

In contrast with the early universities in the midst of European towns are those newly created in the United States upon ample sites and expansive lines. Though Harvard, Yale and Columbia and a few other American universities in less degree are inter-



FROM CHARLES Z. KLAUDER AND HERBERT C. WISE, COLLEGE ARCHITECTURE IN AMERICA. CHARLES SCRIBNER'S SONS

FLOOR PLANS OF PALMER HALL, ADMINISTRATION AND ACADEMIC BUILDING OF SOUTHWESTERN UNIVERSITY, GEORGETOWN, TEXAS. HENRY C. HIBBS, ARCHITECT

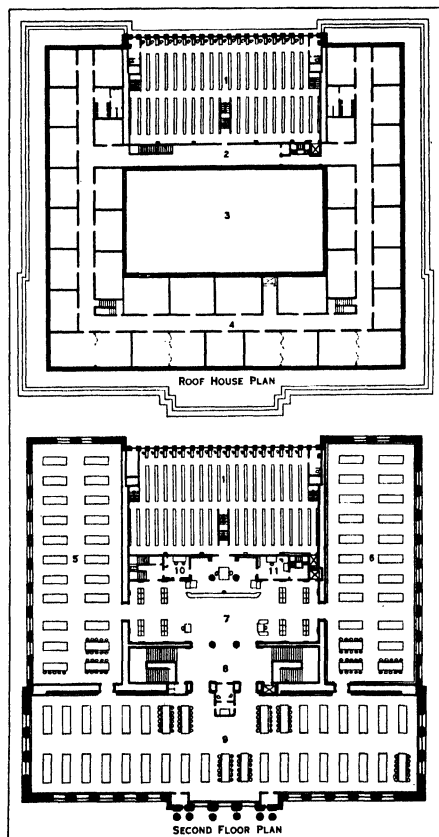
buildings in contradistinction to other secular and ecclesiastical structures.

American College Buildings. The first American college buildings were in the Colonial and Georgian styles derived from English prototypes, e.g., the Christopher Wren Building at William and Mary; Massachusetts and other halls at Harvard; Connecticut Hall at Yale; University Hall at Brown; the group at the University of Virginia, designed by Thomas Jefferson and others. More pretentious buildings subsequently appeared in variations of the Renaissance, and yet later some of the western institutions adopted Spanish and Mission styles. With the dormitories erected at the University of Pennsylvania in the '90s

mingled with their respective cities, the University of Virginia led the way toward an architectural group that was to be self-evident as such. In 1886 a general development plan was prepared for Leland Stanford University. The World's Fair in Chicago was a visual emphasis to American colleges of the importance not only of the design of the buildings themselves but of their grouping and relationship to each other. In 1897-98 an international competition was instituted by Mrs. Phoebe H. Hearst for such a plan for the University of California at Berkeley. Since then other universities have followed in rapid succession to set up for themselves general schemes of architectural development with a view to bringing order out of the

chaos caused by heedlessly locating buildings and offering donors of buildings a choice of sites.

A vital part of these general plans is that heart of American college scenes known as the campus, an expansion of the college yard or green, and its unity, configuration and surroundings as established by a



FROM CHARLES Z. KLAUDER AND HERBERT C. WISE, COLLEGE ARCHITECTURE IN AMERICA, CHARLES SCRIBNER'S SONS

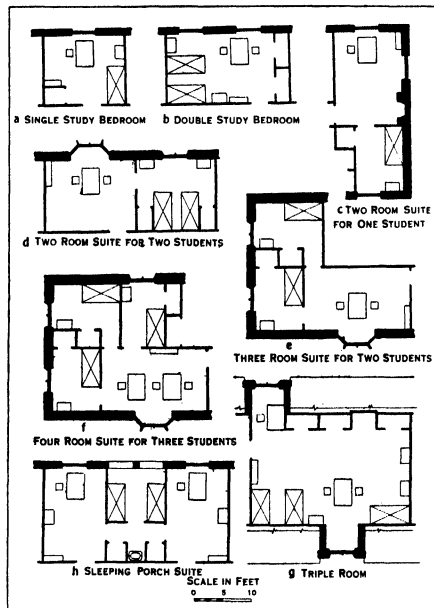
PLANS OF THE LIBRARY OF THE UNIVERSITY OF MINNESOTA
Clarence H. Johnston, Architect

general plan, spell the character of the college architectural scene. This harmony is insured by such means as adopting an architectural style or norm for all the buildings visible from the campus; by using the same materials for the exteriors; by establishing the cornices or eaves at the same level, as may readily be done at such level sites as at the University of Minnesota and the new campus at Illinois.

Classes of Buildings. The modern university embodies so many diverse activities, each requiring a

building ministering to its own ends, that the term college architecture is almost a misnomer, for each of these buildings has more points in common with others of its own class, wherever situated, than with other buildings happening to neighbor it on the college campus. University buildings may be divided in the main as scholastic, scientific, devotional, residential, recreational and managerial. A skillfully devised development plan will segregate and yet coordinate them all.

The scholastic group comprises academic and classroom buildings, those devoted to arts and sciences



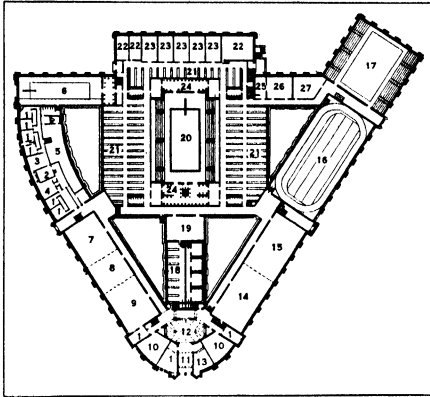
FROM CHARLES Z. KLAUDER AND HERBERT C. WISE, COLLEGE ARCHITECTURE IN AMERICA, CHARLES SCRIBNER'S SONS

TYPICAL METHODS OF ROOM ARRANGEMENT FOR DORMITORIES

(not applied) and other branches, e.g., home economics, for the teaching of which the facilities would not materially differentiate the architecture. Music buildings, if complete and including auditorium, would be in a class by themselves. The scientific group comprises buildings for the various sciences, the rooms consisting in greater part of laboratories and shops. The chapel occupies the devotional class. The library stands in the center of the scheme in a class by itself and is utilized by nearly all other departments of the institution and often the public as well. The residential group comprises dormitories, dining halls, kitchens, etc., and the student union, unless this be counted among the recreational buildings where also are found the gymnasium, athletic fields and stands, field and training houses and the stadium. The man-

agerial group comprises first the administration offices. These are indeed often located in a main building together with classrooms; but their functions bring them into close touch with the central light, heat and power plant, the supply house and stores and also the infirmary.

Unlike investment structures in cities and elsewhere, college buildings are designed for utmost longevity. With safety of life an additional end in mind, the most permanent and fireproof materials are utilized. To clothe these materials assembled by modern methods of construction in an architectural vesture which cultivated opinion will always deem beautiful is to draw upon ancient and modern styles in that eclectic



FROM THE ARCHITECTURAL RECORD

GYMNASIUM DESIGNED BY FREDERICK L. ACKERMAN FOR CORNELL UNIVERSITY, ITHACA, NEW YORK

1, Office; 2, X-ray fluor; 3, women's waiting room; 4, clinical laboratory; 5, women's tote boxes and lockers; 6, swimming pool; 7, boxing; 8, fencing; 9, wrestling; 10, lecture room; 11, vestibule; 12, trophy hall; 13, coat room; 14, calisthenics; 15, apparatus; 16, pole vaulting, jumping and track; 17, basketball, including galleries; 18, faculty lockers; 19, corrective gymnasium; 20, swimming pool; 21, lockers; 22, handball; 23, squash; 24, showers; 25, laundry supply; 26, indoor golf; 27, miscellaneous activities

spirit that has always characterized American designers.

By reason of their comparatively modest requirements buildings for a small college may approach the ideal of intimate beauty and charm; but the problem of the designer becomes more difficult at universities having a student body of 10,000 or more such as the state-supported universities of the West. To accommodate a daily population of such large proportions buildings must be large in scale and the communications greatly expanded with a view to avoiding congestion and loss of time in changing classes. Lecture rooms for a small college may have a capacity of 50 seats; for a large institution more than four times that number may be provided. For the one, the chapel may be upon the lines of an English village church; for the other it approaches the scale of a metropolitan church, if not a cathedral. Large laboratories, large floor spaces, large window areas and the like reveal

themselves upon exteriors. Materials must be chosen as suitable for the traffic and wear and tear of a public building.

C. Z. K.

See Wise and Klander, *College Architecture in America*.

COLLEGE PARK, a city of Fulton and Clayton counties in northwestern Georgia, 8 mi. south of Atlanta, served by one railroad. Candler Field, an important air-mail center, is near by. The city is a beautifully laid out residential suburb of Atlanta, connected by trolley lines with that city. There are no factories within the city limits, but there is a shopping district. College Park is the seat of Georgia Military Academy, an outstanding military school, with a campus of 27 acres, 15 buildings and an enrollment of 300 cadets. College Park was incorporated in 1891 as the City of Manchester, but in 1895 changed its name to the present designation. Pop. 1920, 3,622; 1930, 6,604.

COLLEMBOLA, the scientific name for an order of primitive wingless insects, known popularly as spring-tails. They are very small—almost microscopic—and the majority have a curious spring-like arrangement made out of the tail, which is curved forward under the body. These insects are able to catapult themselves into the air by straightening out the spring. Spring-tails are most often seen in still, shaded pools, where they dart about on the surface. They also are found on the snow in the early spring. Some species are marine and frequent tide-pools.

COLLIER, PETER FENELON (1846-1909), American publisher and philanthropist, was born at Myschll, County Carlow, Ireland, Dec. 12, 1846. He came to the United States with his parents and settled at Cincinnati, O. He completed his education at St. Mary Seminary in that city. Collier began his business career in New York City by selling books from door to door. In 1882 he purchased the printer's plates for a complete edition of Dickens's works and started out as a publisher. In 1888 Collier began *Once-A-Week*, the magazine which in 1895 became *Collier's Weekly*. He was the first to offer books on the monthly payment subscription plan and, by printing editions in inexpensive form, brought the works of standard authors within reach of a wide public. Collier was well-known as a sportsman and breeder of blooded horses. He died at New York City, Apr. 23, 1909.

COLLIERY, a coal mine, or mines, the surface or top works to which the COAL is delivered and the roads leading thereto. The mine itself has been described in MINING, COAL. The coal may come from drifts, slopes, shafts, or from a combination of these. If many beds of coal come to the surface, drifts may be driven into several of these, and the cars of coal arriving at the surface from the mine may be run on a track to the "tippel," or dumping place, usually termed in the anthracite region a "breaker," though that structure always embraces more than just a place to dump coal. After dumping, the coal may slide by a chute into a railroad car. Such coal is known as "run-of-mine." In other cases, it is passed over spaced bars running in the direction of the chute.

The fine coal falls between the bars. Or the run-of-mine may be passed over a "shaker screen," which travels somewhat slowly forward, carrying the coal with it, and then rapidly backward leaving the coal behind. The coal thus moves forward by short jerks. The pan has a bottom full of holes or slots through which the coal of smaller diameter falls. If lump, egg, nut and slack are to be made, there may be three such bottoms, each with smaller holes than the one just above. The coal thus separated may pass to apron conveyors, made of jointed plates, where the slate and bone (impure coal) is picked out by hand from the larger sizes and sent to a refuse dump. The finer sizes are not hand picked, for the work would be too laborious. The various sizes may be carried by loading booms, or apron conveyors, to the railroad cars. The ends of these booms can be lowered into the car and are adjustable. Thus the coal is loaded without breakage. The sizes after the cleaning of the larger coal are sometimes combined and sold as "cleaned mine run."

The finer coal may be separated from the impurity or "refuse" by floating it in water. Clean coal will float in rapidly moving water, especially in a rising current, or if the water is made thick by sand. Rock and bone will also float, but not as readily. With the use of properly planned equipment, the coal is floated off the top, while the slate and bone float away at a lower level or sink. In the latter case the impurity is removed by a conveyor. Sometimes the coal is removed by a sort of winnowing process with air. A table with longitudinal slats, or "riffles," is provided, on which the coal is slowly and regularly "fed." Air comes through the table, which is shaken like a shaker screen so that coal and dirt move toward the far end, directed by the riffles; but the air lifts the coal, and it jumps over the riffles and passes to one side of the table. As the dirt cannot jump as high, the riffles compel it to travel toward the far end of the table. Thus the coal is separated from the impurity. Sometimes water is fed with the coal at the head of the table, and the cleaning is done in much the same manner, water being used instead of air. Again the air may be made to pass through fine sand, and coal being fed into the sand, the dirt sinks in the mixture and the coal floats. The sand is then washed off the clean coal. However, no cleaning will make coal wholly clean, for some of the dirt is part of the original plant life and some is so mixed in dust and lumps that nothing can remove it, unless it is crushed very fine and separated by the use of oil. Even then the plant impurity remains until the coal is burned.

In the anthracite region it has in recent years been found impossible to sell the large lumps of coal. So it is cracked or "broken" in "rolls" set with spikes until it is what is known as "broken" size or even until it becomes "egg." Unfortunately much finer coal is made in the breaking. The place in which coal is prepared as it comes from the mine is called in the anthracite region a "breaker." If the coal

comes from the waste of previous operations, when the fine sizes could not be sold, it is known as a "washer," but at bituminous mines the word "washer" is used to designate all plants cleaning coal by water. A "dry cleaning plant" is one using air instead of water.

The topworks at a colliery may consist of a head frame, or framework over which the cables run from the hoist house to the cages in the shaft, a breaker or tippie, a fan house, or houses where air is delivered to the mines, a lamp house where the safety lamps are cleaned, electric lamps are charged and where the underground workers check in, a power house where power is generated for the colliery and houses, a hoist house containing the machinery for raising and lowering the cages, a repair shop for mechanical and electrical repairs, a bath house where the men dress, and a supply house. Sundry other offices are provided.

R. D. H.

BIBLIOGRAPHY.—H. F. Bulman and Sir R. A. S. Redmayne, *Colliery Working and Management*, Henry Louis, *The Preparation of Coal for the Market*, 1928; E. S. Moore, *Coal*, 1922.

COLLIMATOR, a tube with a TELESCOPE objective in one end and an illuminated target or reticule at the other end in the focal plane of the objective. If the effects of aberration (*see* ABERRATION IN OPTICAL SYSTEMS) are neglected, the rays from any point of the reticule emerge from the objective as a parallel beam which serves to define a direction. If a telescope, provided with cross-hairs and focused for infinity, is directed at the collimator, the image of any point of the collimator target may be brought into coincidence with the cross-hairs of the telescope. When this has been done, the telescope axis will have assumed the defined direction, and this direction will be independent of any lateral displacement of the telescope or collimator so long as the coincidence is maintained. The collimator forms an essential part of the SPECTROMETER and is used for a variety of optical tests.

The auto-collimator is a telescope which serves simultaneously as telescope and collimator. The cross-hairs of the telescope are illuminated. The rays from the cross-hairs proceed through the objective and emerge as parallel light. If a reflecting system is suitably placed in front of the auto-collimator, the light is reflected back through the objective, and the image, situated in the plane of the cross-hairs, may be viewed through the ocular. If the cross-hairs and the image are brought into coincidence, the axis of the telescope is normal to the reflecting system and the coincidence will be independent of any translation but will fail when the reflector or auto-collimator receives any angular displacement.

I. C. G.

COLLINGSWOOD, a rapidly growing suburban residential borough of Camden Co., N.J., situated 3 mi. southeast of Philadelphia and adjoining Camden. It is served by the Pennsylvania and the Reading railroads and numerous motor bus lines. There are several local industries including textile machinery and

printing establishments. The retail business in 1929 amounted to \$2,998,662. Pop. 1920, 8,714; 1930, 12,723.

COLLINGWOOD, a town of Simcoe Co., Ontario, Canada, situated on Georgian Bay, about 93 mi. northwest of Toronto. Industrial and agricultural produce of the region are exported to lake and St. Lawrence River ports, and there are steel shipbuilding yards, planing mills, grain elevators and a government fish hatchery. Two parks and an excellent Indian museum are among the public works. Collingwood was incorporated in 1858. Pop. 1921, 5,882; 1931, 5,809.

COLLINS, MICHAEL (1890-1922), Irish statesman, was born near Clonakilty, County Cork. He lived in England from 1907 to 1916 when he returned to Ireland to join the Irish Volunteers. Fighting in the Easter uprising, he was arrested and sent to a detention camp in 1916. In 1918 he was elected SÍNN FEIN member for Cork. His activities as the director of the Irish armed resistance to England caused a price to be put on his head. In 1921, when de Valera had failed in his negotiation with Lloyd George, Griffith and Collins tried. In their attempt Collins by his geniality and his realization of the limit of British concession did much to bring about the treaty of 1921 and its acceptance by the people. Although he was a republican, he believed the establishment of the Irish Free State a stepping stone to eventual independent government. During the Civil War of 1921, he was killed on Aug. 22 from ambush near Cork. See also IRELAND: *History*.

COLLINS, WILLIAM (1721-59), English poet, was born at Chichester, Dec. 25, 1721. He studied at Winchester College and Oxford, publishing his *Persian Eclogues* in 1742, the year before he graduated at Oxford. He went to London in 1744, met the literary celebrities of the time, including Dr. SAMUEL JOHNSON, and started several ambitious works. Collins's irresolute character, however, hampered his genius, and he left these unfinished. His 12 *Odes* appeared in 1746, and though they won him little fame in his lifetime, they have established him as one of the greater poets of the 18th century. Collins's *Elegy on Thomson* is a work of unusual beauty. His mind became unbalanced and he died at Chichester, June 12, 1759.

COLLINS, WILLIAM WILKIE (1824-89), English novelist, was born in London, Jan. 8, 1824, and was educated at a private school. He studied law, was admitted to the bar in 1849, but preferred writing. In 1848 he published a life of his father, William Collins. His first novel, *Antonina, or the Fall of Rome*, appeared in 1850. Subsequently he met CHARLES DICKENS, and became a contributor to the latter's magazine, *Household Words*. His novels won a quick popularity and are ranked among the first successful examples of the MYSTERY STORY. Some of them, including *The Moonstone*, *The Woman in White* and *The Legacy of Cain* are still well-known. Collins died in London, Sept. 23, 1889.

COLLINSVILLE, a city in southwestern Illinois in Madison Co., situated 12 mi. east of St. Louis and

served by the Pennsylvania Railroad. The city is in a rich farming district and there are coal fields nearby. Collinsville has canneries, lead and zinc works, flour mills and a cowbell factory. Cahokia Mounds State Park, having prehistoric earthworks, is in the neighborhood. Pop. 1920, 9,753; 1930, 9,235.

COLLODION, a solution of PYROXYLIN or soluble NITROCELLULOSE of high viscosity in a 2 to 1 mixture of ether and alcohol. It is a sticky, viscous liquid having the characteristic odor of ether. It is used in medicine for external application. The most widely used one is *flexible collodion*, a mixture of collodion with camphor and castor oil in ether and alcohol. Flexible collodion is used for its physical properties as a protective to the skin. When applied, the very volatile solvent evaporates rapidly, leaving a thin, tough film of nitrocellulose.

BIBLIOGRAPHY.—E. C. Worden, *Technology of Cellulose Esters*, New York.

COLLOIDS, a group of substances, intermediate in particle size between suspensions and true solutions. When compared in velocity of diffusion with the relatively rapid crystalline substances (such as salts, sugar, etc.), colloids are slow in the extreme. THOMAS GRAHAM proposed to designate as Colloids substances of the class of which gelatine is typical, and to speak of their peculiar form of aggregation as the "colloidal condition of matter." "The colloidal is, in effect, the dynamical state of matter, the crystalloid being the statical condition." (See AMORPHOUS STATE.)

A substance may appear either in the colloid or the crystalloid state. Colloidal is, then, a *condition* and not a *kind* of matter. ZSIGMONDY demonstrated the significance of the colloidal state with the ULTRAMICROSCOPE, proving the criterion is degree of dispersion. Particles at the limit of microscopic resolvability generally exhibit BROWNIAN MOVEMENT, a rather confined oscillation about an average position, involving electrostatic repulsions. As particles pass into the ultramicroscopic range, their kinetic motion increases, at first slowly and then with greater rapidity, until at the limits of visibility it becomes enormous in both speed and amplitude. Calculations prove that the motion seen is what the KINETIC THEORY predicts for particles of this size. Particles pass into the colloidal state upon reaching a critical particle size where their activity prevents them from settling out; but they are larger than dissolved salt molecules. The colloidal range is, therefore, from about 0.1 μ to 5 μ . Colloids may be produced (1) by *dispersion*, whereby coarser material is reduced in size, e.g., BREIDIG's electrical atomization and ACHESON's mechanical grinding of colloidal GRAPHITE; (2) by *aggregation*, whereby sub-colloidal particles grow into colloidal dimensions, as FARADAY's formation of red colloidal gold by depriving crystalloidally dissolved gold chloride of its chlorine. The major part of our bodies and of everything we eat, handle and wear consists of material in the colloidal state. The rubber, leather, paper, textiles, food, mining, metal, ceramic and agricultural indus-

tries are among those closely involving colloids and a knowledge of their behavior. The following table shows the possible mixtures of variously dispersed substances:

DISPERSED SUBSTANCE				
DISPERSION MEDIUM		Gas		
		Liquid		
		Solid		
		Solid		
DISPERSION MEDIUM	Gas	No instance exists, because the molecules of all gases are ultra-colloidal	Fine mists and fogs; some "poison gas."	Fine dust clouds, and smokes
	Liquid	Fine froths and foams	Emulsions of oil in water Mayonnaise	Colloidal metals. Fine clay in water
	Solid	Frothy slags	Mercury in ointments. Water in asphalt	Gold in ruby glass. Iron carbide in iron (steel)

Where the same substance constitutes both the dispersed and dispersing phase, we have iso-colloids, e.g., frazil ice in water, sulphur in sulphur. J. A.

BIBLIOGRAPHY.—Jerome Alexander, *Colloid Chemistry*, 1929, R. Zsigmondy, *Colloids and the Ultra-Microscope*. Translated by J. Alexander, 1909.

COLLOTYPE, a photo-mechanical process used in printing for obtaining full-tone reproductions of fine works, as art and old documents. It employs a gelatine plate instead of a screen printing surface. In the preparation of the gelatine plate a ground glass plate is coated with potassium silicate and dried; then it is covered with a sensitized gelatine film, and again dried; finally, it is exposed to light through a continuous-tone, reversed negative, and washed. The gelatine plate is then floated on a metal plate and is ready for printing. Collotype is sometimes combined with other printing processes.

COLLUSION, in law, a secret understanding between parties through which they induce the court to render a decision both desire, although apparently they are opponents. In most cases FRAUD is present, but even if absent, courts do not approve of collusion. A common example of collusion is found in DIVORCE cases, where both parties really desire the divorce, although in court opposing each other. If one of them voluntarily furnishes the other with the necessary evidence, the court if cognizant thereof, will dismiss the action as collusive.

COLMAN, ST. (c. 605-676), noted Irish monk and missionary, was born about 605 in Connaught, Ireland. He is first heard of as a monk of Iona in the Hebrides, where his character and scholarship brought about his election as bishop of the Holy Island of Lindisfarne in 661. From 665 to 667 he founded several churches in Scotland and at length, with 30 disciples, set sail for Ireland, settling at Innisboffin, Co. Mayo, in 668. Three years later he erected an abbey exclusively for

English monks, whence the name "Mayo of the Saxons." He died on the island of Innisboffin, Aug. 8, 676.

COLMAR, a picturesque city in eastern France, capital of the department of Haut-Rhin, situated on

the small rivers Lauch and Logelbach. An important town of medieval Alsace, Colmar was ceded to France in 1681, annexed to Germany in 1871 and restored to France by the World War. Textiles form its chief industry, and it trades in Alsatian wines. Colmar contains several interesting churches, a 15th century trade-hall and a 13th century Dominican monastery, now a museum. Pop. 1931, 46,518.

COLOCYNTH (*Citrullus Colocynthis*), a climbing or long trailing plant of the gourd family, widely distributed in tropical Asia, Africa and Mediterranean countries. It is a rough perennial herb with an angular stem, deeply lobed leaves and many-seeded fruits somewhat resembling oranges. The spongy, very bitter fruit-pulp yields the cathartic drug known as colocynth which is much used in medicine. See CATHARTICS.

COLOGNE (Ger. *Köln*), the largest city in the Prussian province of Rhine, situated on both banks of the Rhine, about 21 mi. south of Düsseldorf.

Site and Buildings. The largest part of the city is on the west bank, forming a semicircle. The large Ring Street now follows the outline of old fortifications. The chief squares are the Cathedral Court, the Old Market, Haymarket, New Market and Hansaplatz. There are 158 Catholic churches, 14 Protestant and 5 synagogues. Among the churches, the foremost is the great Gothic cathedral begun in 1248. Cologne also has Romanesque churches of great importance, including the 4th to 13th century St. Gereon's, St. Pantaleon's and Great St. Martin's, both of the 10th century. The most noteworthy of the other old buildings are the 15th century rathaus, the 13th and 14th century Templar House and the city gates of the 14th century. Among modern buildings are the government building, palace of justice, university and opera house. There are 11 parks in and about the city, including two woods and a sport park

with a stadium, also many statues of rulers, warriors, statesmen and writers, as well as fine fountains.

Manufactures and Trade. Cologne is the most important industrial city in western Germany, with over 300 large plants, largely metal and machine works. The manufacture of clothing, food products and chemicals, as well as smelting and coal mining are also important. "Cologne" is a well known product and there are also many other specialized industries. Cologne is the leading commercial center of western Germany, the principal commodities being wine, grain, coffee, tobacco and building materials.

Transportation. As chief railroad center of western Germany, Cologne has several passenger and freight stations. Seventeen lines converge in the city. There is also heavy shipping on the Rhine, which is taken care of by four harbors, one of which has been built since 1927. Besides many steamers, there is also much lumber floated downstream. Cologne is the terminus of the Rhine-Oceanic shipping with direct steamers to Rotterdam, London and other ports. It is also an important airport, being located at the intersection of several international air lines.

Educational Institutions are highly diversified and well attended, particularly the university, which was founded anew in 1919. There is a German-South American and Iberian Institute, as well as other specialized schools for nearly all branches of knowledge. Museums are also numerous and diversified, as are the libraries and archives.

History. Founded in 50 A.D. as a veteran colony, called *Colonia Agrippinensis* after the Roman Empress Agrippina, it soon developed into a populous city, which retained its rank as a political center under the Frankish rulers. The citizens sometimes sided with, sometimes against the archbishops, until they became independent in 1288 through their trade with England and through joining the Hanseatic League. The fortifications, built from 1106 to 1180, gave the city its aspect until 1880. Since the war, it has progressed with its sample fairs, university and incorporation of suburbs. Pop. 1925, 700,222.

COLOGNE CATHEDRAL, a noble specimen of decorated Gothic architecture in Cologne, Germany. It is situated 60 ft. above the Rhine, near the Hohenzollern bridge. The design is credited to Gerhard von Rile, and is taken from Amiens Cathedral. The building was begun in 1248 and work was carried on intermittently for over 600 years. Finally in 1880 the construction including the towers was completed. It has a length of 443 ft., a width of 200 ft. and a height to the roof of 201 ft. The height of the central tower is 357 ft. and of the two main towers 512 ft. The interior is unusually inspiring because of its soaring height and the beauty of the stained glass windows. The cathedral contains the relics and shrine of the three Magians for which reason it has been the goal of many pilgrimages. In the south tower is a great bell called the Kaiser-glocke which was cast in 1874 from conquered French cannon.

COLOMBIA, a republic in the extreme northwest of South America, bounded on the north by the Caribbean Sea, on the east by Venezuela and Brazil, on the south by Peru and Ecuador and on the west by the Pacific Ocean and Panama. The coast line is about 1,100 mi.—460 mi. on the Pacific and 640 mi. on the Caribbean. Area about 482,400 sq. mi. Pop. 1928, 7,851,000.

Surface Features. The area falls into two approximately equal parts of totally dissimilar character. The most populous and better known portion, that of the north and west, is divided longitudinally by a series of mountain ranges enclosing great river valleys. The southeast, which lies beyond the mountains, consists of great well-watered plains or savannas, 300 to 500 ft. above sea. The Andes in three massive ranges traverse the country for the entire thousand miles of its north-south extent, and in the north spread out like three great fingers. These are the eastern, central and western Cordilleras. Between the mountain ranges whose highest peaks exceed 20,000 ft. three rivers flow northward: the Atrato, the Cauca and the Magdalena. The Magdalena, about 1,000 mi. long, is the country's chief river and highway of commerce.

Inhabitants. The population has concentrated in the uplands in order to avoid the unfavorable tropical climates. Routes of trade have added to the influence of climate in peopling the highlands. Two major districts of concentration have arisen: one on the broad fertile plateau about Bogotá, the capital; the other in numerous valleys around Medellín. The white element, composing about 10% of the total, is one of the most progressive in the continent. These live almost without exception in the highlands. Far below them in status are the mestizo masses who make up the bulk of the population, also living chiefly in the more temperate heights. Indolent Negroes and mulattoes constitute a third and numerous group. They inhabit the coastal regions and river valleys. Of pure Indians there are three types: the virtually independent tribes of the Goajira Peninsula, the descendants of the aboriginal Chibchas of the plateaus, and the various scattered groups of the eastern plains.

Climate. Mainly on account of the highly diversified relief, Colombia has a great variety of climates. So completely is latitude neutralized by elevation on the uplands that some of the more favored plateaus enjoy a delightful climate despite their proximity to the Equator. There are two wet seasons when the sun is at the zenith, and two dry seasons when it approaches the tropics. On the Bogotá tableland the temperature varies less than 1° between the coldest and warmest weather, while the annual rainfall rarely exceeds 45 in. A contrast is presented by the sultry inland plains where the mean temperature seldom falls below 86° F., and in some places 90° or 91°. The Magdalena and Cauca valleys are about 10° hotter than the Atlantic coastlands. The rainfall is excessive on the Atlantic seaboard, ranging from 100 in. about the Santa Marta slopes to perhaps 200 on the Pacific slope.

Forest Products. Most of Colombia supports a forest vegetation; unforested areas include the arid Goajira Peninsula, the Bolivar and Llanos savannas, the upper Cauca and Magdalena valleys and the grass lands and *paramos* of the high regions; mountain forests include many species found in the lowlands of the middle latitudes. A large variety of medicinal products are found, balsams, gums, resins, waxes, dyes and nuts; yet the difficulties of obtaining them from the dense and unhealthy forests and of delivering them to the sea coast are so great that comparatively little is done. Quinine and rubber production has become unimportant. Tagua nuts, from which vegetable ivory is made, are abundant and are exported in considerable quantities. Chicle, used in making chewing gum, is gathered and exported in good quantities. Mahogany and cedar are shipped abroad.

Fauna. Of the living fauna both the mammals and most of the birds, like the plants, belong to the same genera or species as those inhabiting other tropical and semi-tropical countries. Such are the puma, jaguar, sloth, ant-eater, tapir, peccary, ape, king vulture, eagle, toucan and humming bird.

Agriculture. Most of the agriculture is upland and mountain crops, carried on rather crudely and under severe handicaps. Four food crops are raised everywhere, yucca, corn, sugar cane and plantains, and they form the staple foodstuffs of the people. A large fruit company has extensive banana plantations near Santa Marta on the Caribbean coast. Coffee has become an important Colombian product. There are two or three scientifically managed sugar plantations. Tobacco is grown and exported, and tobacco manufacture, especially of cigarettes, is one of the leading, though small industries of the country.

Mineral Resources. The mining industry shows great promise. Practically every mineral of commercial value has been found, including the rarer metals. Colombia and Russia lead the world in the output of platinum. Colombia also turns out most of the world's emeralds. The annual output of gold amounts to about \$5,000,000. A few thousand tons of fair quality coal are mined along the new railway from Medellin to the Cauca valley and supply local industries. The petroleum developments have undergone a rapid rise. Whereas the first shipment of crude oil was made in 1926, the country produced 20,385,000 bbls. in 1929. Large scale mining in Colombia awaits the development of transportation, the rise of a skilled labor class and the influx of capital.

HISTORY

Alonso de Ojeda reached the north coast of Colombia in 1499. A decade later Ojeda and Diego de Nicuesa, who briefly held royal grants of territory, promoted the first settlements, the survivors of which concentrated in the town of Santa Maria la Antigua on the isthmus of Panama. The oldest surviving settlements are Santa Marta, 1525, and Cartagena, 1533. Gonzalo Jimenez de Quesada in 1536 led an expedition which, starting from Santa Marta, pushed

up the Magdalena River into the mountainous interior, conquered the semi-civilized Indians and founded the Government capital, Bogota. Other centers of Spanish settlement were established in Antioquia and in the upper valley of the Conca River. The region, known as the captaincy-general of New Granada, was in 1739 elevated to the status of a vice-royalty; but the country remained economically backward until the close of the colonial era. Insurrection against Spanish authority began in 1810; a period of almost incessant warfare ended when in 1524 Spain withdrew from the contest. From 1819-30 New Granada was a part of the Republic of Colombia, including Venezuela and, after 1821, Ecuador. In 1831 the Republic of New Granada was established, its limits corresponding to the present Colombia; the latter name was adopted in 1863.

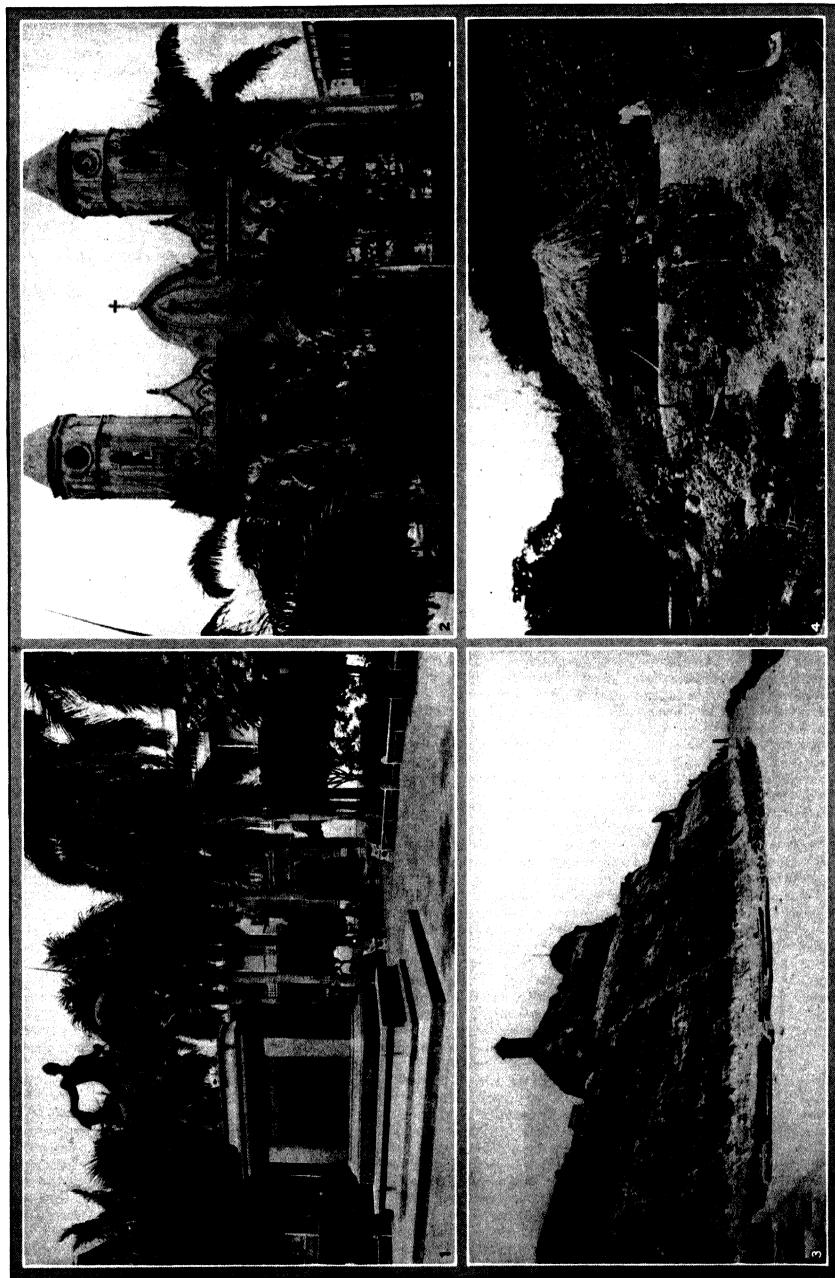
The republic was instituted with Francisco Santander as president. He followed a liberal, progressive policy; but his political intolerance and militaristic methods led to the election of an eminent civilian, José Ignacio Marquez, in 1837. A pro-clerical rebellion after the suppression of certain convents plunged the country into civil war. Tomás Cipriano de Mosquera, a cultured aristocrat who became President in 1845, promoted notable educational and economic advances. During an era of Liberalism which began in 1849, slavery was abolished, Church and State were separated, and, 1855, the subdivisions of the republic were permitted to become Federal states with considerable autonomy. Measures calling for the inspection of election returns by the Central Government and otherwise limiting the prerogatives of the state officials, led to another civil war in 1860. Mosquera repossessed the presidency from 1861-67. Following a succession of Liberal presidents, and a period of increasing political disorder, Rafael Nuñez became chief executive in 1884. The constitution of 1886, reflecting his theories, restored centralism in Government and declared Roman Catholicism the State religion. The period of Conservative predominance was ended in 1930, when Enrique Olaya Herrera, a Liberal, owing to a schism in Conservative ranks, was elected President. In foreign affairs, the Panama issue (see PANAMA, *History*; PANAMA CANAL) remained highly important until in 1921 the United States awarded Colombia \$25,000,000 and special commercial privileges in compensation for the loss of Panama. The last of a series of boundary disputes, involving Costa Rica, Peru, Ecuador and Brazil, was adjusted in 1928.

BIBLIOGRAPHY.—J. M. Groot, *Historia eclesiástica y civil de New Granada*, 3 vols., 1869-70; C. R. Markham, *The Conquest of Nuevo Granada*, 1912; Jules Humbert, *Histoire de la Colombie et du Venezuela des origines jusqu'à nos jours*, 1921.

COLOMBIAN LITERATURE, the literature of the Republic of Colombia, South America, treated under the heading, LATIN-AMERICAN LITERATURE.

COLOMBO, the capital and principal seaport of Ceylon, on the west coast of the island. It is the commercial center of the colony, has an excellent

COLOMBIA



1. 3. 4. BROWN'S PHOTO SERVICE; 2. COURTESY UNITED FRUIT CO.

IN THE COASTAL CITIES OF COLOMBIA

1. Statue in Cartagena of the great liberator of South American republics, Simon Bolivar.
2. Cathedral of Barranquilla.
3. Fort of San Felipe, Cartagena, now a reservoir for city water.
4. Native hut near Cartagena.

COLOMBIA

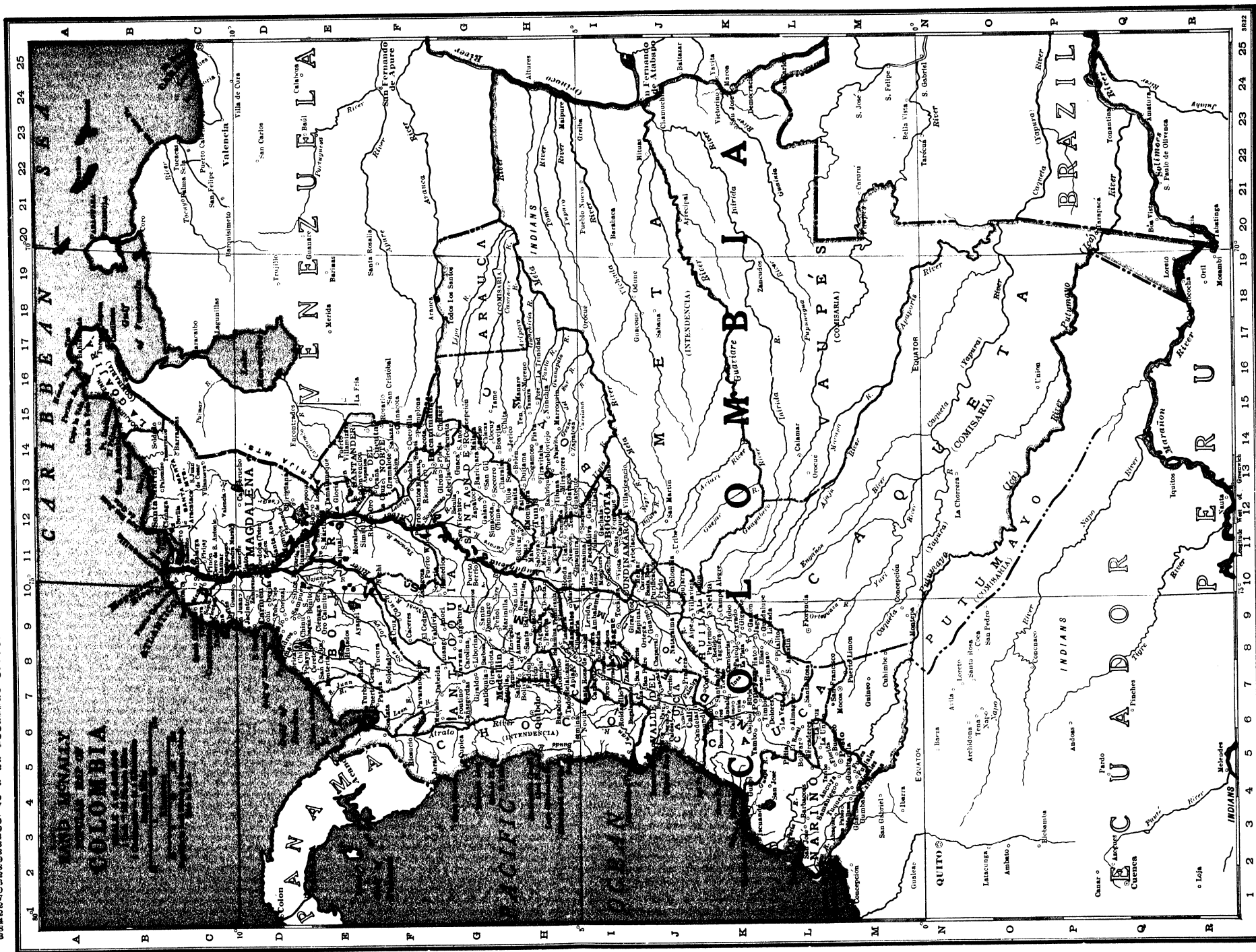
Area 440,846 sq.m.

Pop. 7,851,000

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)

Pop. Thousands	
28	Aguandás . . . H 8
22	Andes . . . H 8
16	Anolaima . . . H 10
17	Armenia . . . H 8
12	Barbacoas . . . L 3
13	Barichara . . . G 13
140	Barranquilla . . . B 10
235	Bogotá . . . B 10
13	Bolívar . . . H 11
16	Bolívar . . . H 11
16	Bolívar . . . L 5
44	Bucaramanga . . . B 14
14	Buga . . . J 7
16	Calarcá . . . J 7
123	Cali . . . F 6
15	Caqueza . . . H 11
17	Cartago . . . D 10
86	Cartagena . . . C 9
21	Cartago . . . H 8
16	Chaparral . . . D 9
13	Chinu . . . D 9
26	Ciénega . . . B 12
12	Concepción . . . B 13
12	Corozal . . . D 9
49	Cúcuta . . . F 6
16	Espinal . . . B 19
11	Facatativá . . . H 11
13	Flandia . . . H 8
13	Florencia . . . H 12
20	Fredonia . . . H 8
14	Gacheta . . . H 12
12	Garzón . . . K 6
13	Girardot . . . H 10
10	Guamo . . . D 9
11	Guapi . . . D 9
54	Huacá . . . H 9
17	Ipiques . . . M 4
14	Iruque . . . G 8
19	Jericó . . . H 11
15	Jesus María . . . H 11
12	Junín . . . H 11
11	La Cruz . . . D 8
20	Lorica . . . D 8
85	Manizales . . . H 8
120	Medellín . . . H 13
11	Miraflores . . . H 13
16	Mompós . . . D 11
13	Moniquirá . . . H 12
23	Montería . . . H 8
14	Natagaima . . . J 9
30	Neiva . . . K 9
17	Ocaña . . . F 13
14	Ortega . . . H 13
14	Pacora . . . H 8
11	Palpa . . . H 13
27	Palmita . . . J 7
14	Pamplona . . . F 14
43	Pasto . . . M 5
14	Pensilvania . . . H 8
25	Perleira . . . H 8
15	Pitalito . . . L 8
32	Popayán . . . K 7
11	Pueblo Vieja . . . H 13
17	Purificación . . . H 10
25	Quibdo . . . H 6
16	Rionegro . . . F 13
19	Itiosucio . . . H 8
16	Sabánalarga . . . H 10
12	Saboya . . . H 11
11	Sahagún . . . D 9
20	Salamina . . . H 8
11	Salazar . . . H 11
14	San Andrés . . . G 14
11	San Gil . . . G 13
13	San Juan . . . D 10
12	San Onofre . . . D 9
13	San Pablo . . . M 4
12	Sa. Barbara . . . H 8
22	Santa Marta . . . B 12
21	Sa. Rosa de Cabal . . . L 8
12	Sa. Domingo . . . G 9
12	Santander . . . K 7
11	Sitonuevo . . . C 11
17	Sinca . . . D 10
15	Sincedejo . . . D 9
13	Sota . . . H 14
13	Recorro . . . H 13
17	Sogamoso . . . H 13
28	Sonson . . . H 9
14	Tamose . . . H 8
11	Tibana . . . H 12
14	Timbio . . . K 8
12	Tocaima . . . J 10
15	Tulua . . . J 7
15	Tumaco . . . L 2
19	Tunja . . . H 12
17	Tiquero . . . M 4
20	Yarumal . . . G 8
11	Zapoteca . . . G 13



artificial harbor and is a port of call at the junction of many ocean routes. An extensive fort is built on a projecting point of land. Pop. 1931, 287,729.

COLON, that part of the large intestine extending from the cecum to the rectum, is a tube about two or three inches in diameter and six feet long, resembling a horseshoe with the points downward. The vertical portion, or ascending colon, on the right side, begins in a blind pouch, known as the cecum. The small intestine also enters the cecum on its inner side, while at its tip is located the vermiform appendix. As the ascending colon reaches the stomach, it is slung across under it, hammock-wise, and on the left side turns down again, becoming the descending colon, which ends in the rectum.

The colon is lined with mucous membrane, which secretes mucus but no enzymes or digestive ferments. There are two layers of muscle in the wall, the fibers of one layer running circularly and of the other longitudinally. The contraction of these muscles causes wavelike movements in the colon, known as peristalsis, which propels the contents of the intestine along the alimentary canal.

The chief function of the colon is the absorption of fluids, especially water. However, the large intestine not only absorbs proteins, but continues their digestion. *See also* ALIMENTARY CANAL; DIGESTION; INTESTINES.

COLON, a seaport of the republic of Panama, situated at the northern entrance to the Panama Canal. It is the capital of the province of Colon and the second largest city of the republic. Colon was founded in 1850 during the construction of the Panama railway. It gained further importance during the digging of the Panama Canal. Now it is one of the busiest ports of the Caribbean and a great tourist center. The natives are mostly *Mestizos*, but the tradesmen come from all parts of the world. Before the construction of the canal Colon was an unhealthful spot, but American sanitary measures under the direction of General Gorgas at the time of the canal work cleared the marshes, which bred mosquitoes, and made Colon free from malaria and other diseases. Pop. 1930, 33,460.

COLONATE, a Roman institution of the late Empire, superficially resembling serfdom. Those subject to the colonate, called *coloni*, were free men with all the capacities of citizenship save that of leaving the estate to which they were inseparably attached, or taking legal action against the master of that estate, both of which generalities had exceptions, noted below. They possessed property, some of which they could alienate, and they could marry, as slaves could not; they paid a fixed tax on the land they held, to the master of the estate, called their patron, and a poll tax individually to the State. If the patron raised the land tax, he could be sued. The only escape from the condition of colonate was military service. This suggests the reason for the institution, for of all the needs of the Empire after the 3rd century, adequate defense was first, and provisions second; and it was

the latter, through the taxes and produce resulting from the colonate, which explains this institution. Its origin is disputed; but it is doubtful whether the ancient relationship between a great man and his dependents, or clients, could have produced it. It has been suggested that the infiltration of barbarians into the Empire necessitated some disposition for them, and they were accordingly settled on the land to become producing factors for the State. The appearance of Romans as *coloni* might have been caused by the comparative security of that condition, which might well have appealed to those deprived of other means of maintenance.

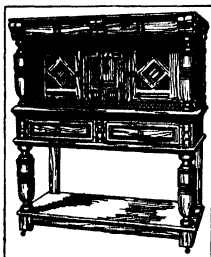
COLONEL, a military officer ranking between a brigadier general and lieutenant colonel. His usual command is a regiment of infantry, artillery or cavalry, although he may serve in a staff position with no command. His insignia is the silver eagle. In the Navy the corresponding grade is that of captain.

COLONIAL DAMES OF AMERICA, NATIONAL SOCIETY OF, a patriotic society of American women, founded in 1890 in New York City and representing the 13 original colonial societies as well as the associate societies from states admitted after colonial times. The organization aims to preserve records and manuscripts of colonial history and relics and buildings of the time. In this interest they have restored and furnished the Van Cortlandt Manor House in New York City in the colonial tradition and marked historical spots with tablets. Prizes are given to public school children for essays on historical and patriotic subjects. Members are restricted to women of direct descent from a distinguished colonial ancestor. Admittance must first be obtained through the society in the state where the ancestor performed his service. The national society membership is more than 1,000. During the Spanish American and the World wars, the Colonial Dames were active in patriotic work.

COLONIAL NATIONAL MONUMENT, a composite monument in Virginia, established Dec. 30, 1930, embracing a total area of 1,960.52 acres. It comprises three regions of historical importance, Jamestown Island, Williamsburg and Yorktown. Jamestown Island, situated in the James River 37 mi. northwest of Norfolk is the site of Jamestown, established in 1607, the first permanent settlement made by the English in the United States. Williamsburg was the seat of the government of Colonial Virginia for nearly a century. Yorktown was the scene of the culminating battle of the Revolution and the surrender of the British under Lord Cornwallis, Oct. 19, 1781.

COLONIAL STYLE, a name given loosely to any style developed by settlers from a mother country in a colonial possession; especially the American Colonial style developed by the English settlers in the North American colonies in the 17th and 18th centuries. The chief characteristic of all colonial architecture is the attempt to create the atmosphere of the mother country in a new environment. This attempt is made even

where climate and materials may both be different, and where there may be also among the settlers a lack of trained artisans and designers. The 17th century work in America was largely under Tudor and even Gothic influences. Half timber construction was common, though hidden under a covering of shingles or clapboards. The church of St. Luke's at



COURTESY M. M. OF ART

AMERICAN CUPBOARD WITH
TURNED DECORATION, 17TH
CENTURY

Smithfield, Va., shows many Gothic elements. Later, as trained builders and craftsmen came over, the classic style of INIGO JONES and WREN dominated American work, and the frequent importation of English architectural works, as well as the growth in the knowledge of the American carpenters, cabinet makers and masons, led to a development of an American classicism very like that of England. The general use of wood as a building



PHOTO R. I. HESMITH AND ASSOCIATES, NEW YORK

FAIRBANKS HOUSE AT DEDHAM, MASS., SHOWING GAMBREL ROOF
The oldest wooden structure in the United States, this building
was possibly erected in 1606

material, the differences of climate, and in some cases the comparative poverty of the colonies produced however many differences, especially in general architectural forms. In general, the work of New England is the least like that of England, and the work of Pennsylvania most like it. Occasionally Virginia mansions, like Westover or Mt. Airy, are almost identical with some of the English houses. In churches,

type work, American Hepplewhite and Sheraton are really post-Revolutionary. Colonial is even applied occasionally to American decorative work of the Empire type. Spanish Colonial is the style of the Spanish colonies in America, varying from such perfect reproductions of the rich Spanish Baroque as the Church of San Sebastian y Santa Prisca at Taxco, Mexico, to the simple rough picturesqueness of the California Missions, as for example at Santa Barbara, 1787-1800. Dutch Colonial is a term now generally used not only for the actual work produced in New Amsterdam



COURTESY M. M. OF ART

BLOCK-FRONT MAHOGANY BUREAU, DE-
SIGNER BY JOHN TOWNSEND, NEW-
PORT, R. I., IN 1765

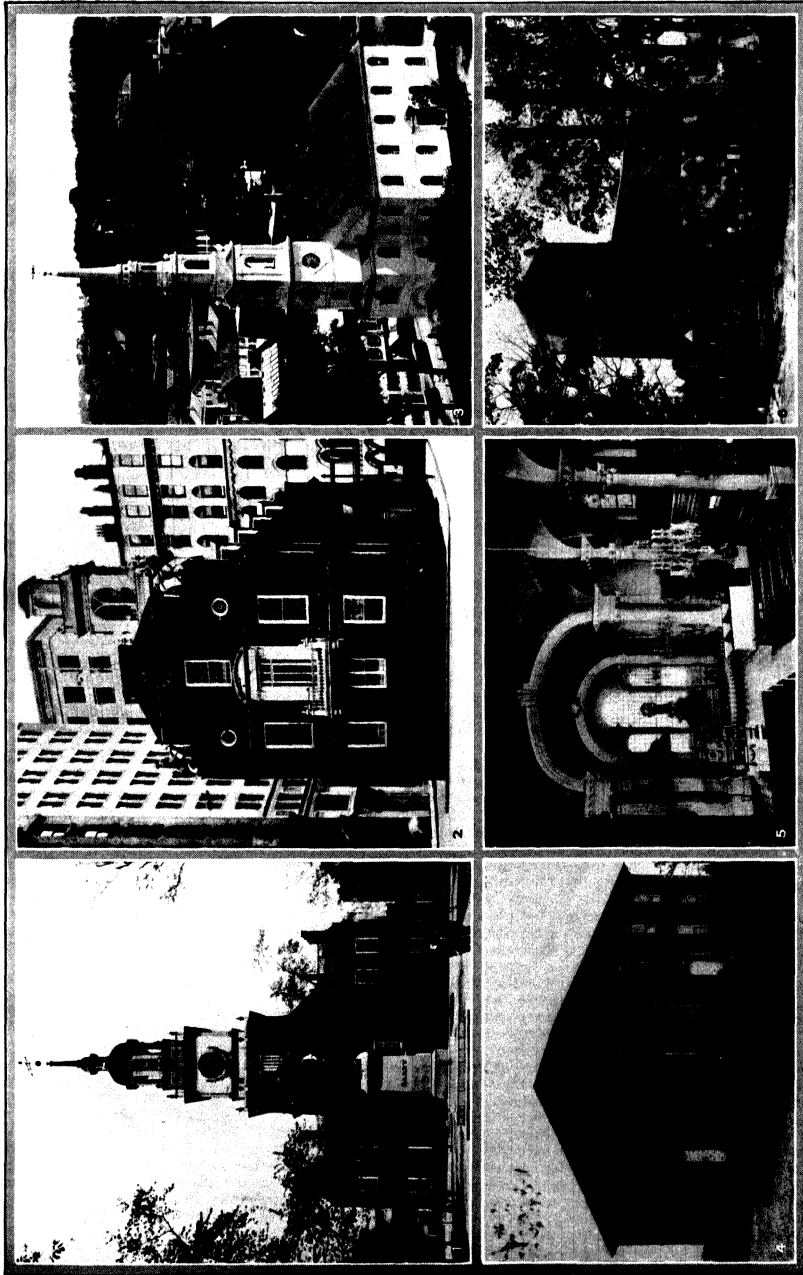
under Dutch domination, but also for a great deal of New York State and New Jersey work even into the 19th century. The local peculiarities of the style, such as the considerable use of turned baluster shapes, confused scale and enormous fan decorations, were thought, with but little basis, to be due to the persistence of Dutch tradition. For bibliography see under RENAISSANCE ARCHITECTURE; MODERN ARCHITECTURE.

T. F. H.

COLONNA, VITTORIA (1490-1547), Italian poetess, was born at Marino, near Rome, in 1490. She was the daughter of Fabrizio Colonna, Grand Constable of Naples. At 17 she was married to Ferrante d'Avalos, son of the Marchese di Pescara. After her husband's death in the Battle of Pana (Nov. 1525) she sought consolation in poetry and became the center of a distinguished literary and artistic group. MICHELANGELO addressed many sonnets and madrigals to her. Vittoria's poems, which are chiefly sonnets in memory of her husband, are characterized by a beautiful melancholy and spiritual exaltation. She died in Rome, Feb. 25, 1547.

COLONNADE, a row of columns, joined together by an entablature. When a colonnade surrounds a building or court it is called a peristyle. When it forms a separate projection, commonly as an entrance porch, it is called a portico. The colonnade has been popular from very ancient times. In Egypt it was used both in the form of a series of columns to mark divisions in a hall, and in peristyle construction about an open inner court. Mesopotamian builders used the colonnade little, but occasionally in-

COLONIAL STYLE



1. ERING GALLOWAY PHOTO; 2. COURTESY BOSTON CHAMBER OF COMMERCE; 3. REISSONE VIEW CO. PHOTO; 4. WANTS BROTHERS PHOTO; 5. H. P. COOK PHOTO. RICHMOND, VA.

SURVIVING EXAMPLES OF AMERICAN COLONIAL ARCHITECTURE

1. Independence Hall, Philadelphia, originally built as the State House, 1733-41. Andrew Hamilton, Architect. 2. Old State House, Boston, one of the earliest monumental government buildings in America, built near the beginning of the 18th century. 3. First Baptist Church, Providence, Rhode Island, 1775. Joseph Brown, Architect. 4. Pohick Church, Fairfax County, Virginia, 1769. George Washington, it is said, drew the plans for the church. 5. Interior of St. Paul's Chapel, New York, 1764. MacBean, Architect. 6. St. Luke's Church, Smithfield, Virginia, built about 1636, the oldest church still standing in the English colonies of North America.

COLONIAL STYLE



1. COURTESY METROPOLITAN MUSEUM OF ART; 2, 3. EWING GALLOWAY PHOTOS; 4. ESSEX INSTITUTE PHOTO, SALEM, MASS.

SOUTHERN AND NEW ENGLAND GEORGIAN ARCHITECTURE

1. The Wentworth-Gardner House, Portsmouth, New Hampshire, built in 1760, now owned by the Metropolitan Museum.
2. Westover, near Richmond, Virginia, 18th century home of the Byrd family.
3. Morris-Jumel Mansion, New York City, built in 1765.
4. Michael Dalton House, 1746, Newburyport, Massachusetts.

roduced a portico. Greek architects developed it generally, and in Rome it was a widely prevalent feature. The coupling or pairing of columns in a row was introduced in the later Renaissance and found great favor in the classic revivals.

COLONY. A distinction is sometimes made between a colony and a dependency. In the original Greek use of the term a colony was a territorial unit outside a state, settled by people from the parent state. Using the word in this sense a colony was thus not a dependency held in subjugation but a territorial unit, often self-governing, bound to the parent state primarily by ties of nationality and continent. In the modern era the line of demarcation between the two terms has become exceedingly hazy. Thus the English "crown colonies" were neither settled from the parent state nor are they self-governing. In the ancient world, colonies were either trading posts or centers of influence set down among alien subject races. Modern colonies, however, have come into existence primarily owing to the desire of the industrial countries of the western world to have markets for their manufactured products and control of the raw materials needed by the factories. These two desires account for most of the colonial expansion of the last 50 years.

COLOR, that attribute which makes objects appear to the eye in other hues than shades of gray. A distinction should be made between the pure color of monochromatic rays of LIGHT and the mixed color of light from pigments in plants, animals, paints or textiles. The former is, so to speak, true color, but is rarely met with; while the latter, which comprise practically all the color we experience, is impure. A monochromatic ray of light, or a ray of a single color, is produced, according to the QUANTUM THEORY, as a result of a disturbance in the internal configuration of ELECTRONS in an ATOM, whenever such a disturbance is accompanied by a release of energy. The amount of energy determines the color, or the WAVE-LENGTH, of the light, large amounts resulting in blue or violet light, small, in red light.

Sunlight and such artificial light as is produced by incandescent bodies, as the filament of an electric lamp, the gas mantle and even the carbon particles that form the flame of a candle, contains all colors, that is to say, all wave-lengths of radiant energy to which the human eye is sensitive. This may be proved by passing such apparently white light through a prism whereby the colors are separated out into a spectrum. The hotter sources contain relatively more blue light than the cooler ones, hence, candle light appears yellow as compared to sunlight.

When a particular color, red, e.g., is subtracted from white light, the remaining combination of colors will appear as the complementary color, blue-green in this case. Similarly, blue and orange are complementary, as are purple and yellow. To this are due the apparent colors of all pigments that are seen by reflected light. An object that appears blue-green when illuminated by white light, may do so for two reasons:

either because it absorbs light (*see* ABSORPTION OF LIGHT) of all colors except blue-green, which is rarely the case, or, more usually, because it absorbs red light much more strongly than it does any other color. Also, an object entirely incapable of reflecting yellow must appear black when illuminated by pure yellow light. This last accounts for the variation in color an object seems to undergo when moved from sunlight into artificial illumination. The balance of color in these lights differs. Furthermore, a restricted class of substances, called fluorescent (*see* FLUORESCENCE), have the ability of changing the color of the light they receive, generally making it redder. Here, the light is not merely reflected, but first absorbed and then re-emitted.

Neither the physiological nor the psychological aspect of the recording and appreciation of color by the human eye has as yet been completely explained. It appears, however, that the recording mechanism lies chiefly in the cones of the retina (*see* EYE), in which the primary impulse is separated into four to six different impulses by a color-distinguishing device, probably operating by photochemical action, and then transmitted to the seat of sensory appreciation. The aesthetic sense of color perception would seem to be partly a result of cultural development in which a liking for soft, subdued tints gradually augments and partially displaces a primitive love for bright, garish hues. W. J. L.

COLOR, in painting, is a matter of pigments for the use of painters, dyers and printers and is not usually considered in the writings of color-ray scientists. It is a different science based upon chemistry.

Carl Runge (1856-1927) of Hamburg started the general awakening in the 19th century. M. E. Chevreul (1786-1889), superintendent of the dyeing department of the Royal Manufactories (Gobelins) in France, also wrote much that was enlightening, particularly concerning the coloring of fabrics. In 1874 O. N. Rood (1831-1902) of Columbia University published what has been considered an indispensable work on color, *Modern Chromatics*. These and lesser authorities have argued from the scientists' point of view, some discarding the theory that red, yellow and blue are the pigment *primaries*, some trying to alter it more or less, and some insisting upon its infallibility with almost religious enthusiasm. These writers have not been painters, and their findings, true or false, have not affected particularly the procedure of those who use paint pigments. C. E. Munsell (1858-1918) went far in his experiments and wrote more pertinently on the subject of pigments. His slight modifications of the *complementary* colors alter the common understanding of them only if one agrees upon his choice of which red is *primary*, which yellow and which blue. Paint-pigments do not possess that precise red and yellow and blue, but the all-important fact remains that the *complement* of any color is always the sum of the remaining colors of the spectrum, as closely as they have been determined, and this is the definite knowledge that pertains to the use of com-

plementary colors. In former days paint pigments were manufactured from natural sources, some from minerals, some from vegetable matter and some from animal matter. Now the chemist manufactures them all synthetically except the earth colors, which are the ochres, the siennas and the umbers. It is likely that more and more the chemist may approach the precise red and yellow and blue that will be the exact primaries for mixture. Meanwhile, the pigments that are most nearly primary are rose-madder, lemon-yellow and ultramarine blue; or, more exactly, they are rose-madder over vermilion, lemon-yellow and French ultramarine blue.

The pigments used in dyeing and printing are practically all coal tar products. Of the pigments used for painting experienced artists use no coal tar products except those that are called the Madder Lakes (rose madder and Alizarin crimson). White lead has been used for 2,000 years, and still is preferred for house-painting. Zinc white was discovered about 1850, and because it is less affected by sulphurous gases, and is friendly to more of the other colors in mixture with them, it is better for the PALETTE than white lead, and is generally used by painters of pictures. Black is either ivory black, made from ivory chips by charring, or lamp black, which is condensed smoke in the form of soot. Black is a source of irritation and difficulty when used as a pigment for darkening other colors. It is not needed as a darkening color. The process of darkening can be achieved for each color by adding to it in mixture some of the color which is its *complementary*. In fact, black is not the darkest color; deep purple is the darkest. Also, white is not our lightest color; lemon-yellow is the lightest. The lightest colors are the ones that reflect the most light, and the darkest colors are those that reflect the least light. Thus white can be made lighter by the addition of lemon-yellow, and black can be made darker by the addition of purple. Any tone of a color that is lighter than the color itself is called a *tint* of that color. For instance, lavender is a tint of purple, and orchid is a tint of red-purple. Any tone of a color that is darker than the color itself is called a *shade* of that color.

There is good reason why the colors of a painter's palette should be of the most brilliant quality that he can obtain. The chemical changes that result from the mixing of colors will then be easier, surer and clearer in effect.

So far as is known, nothing has any color of itself. Each thing or part of a thing that appears to be blue is that color in appearance only because of the fact that the blue rays in light succeed in lighting it, whereas the other colors of the spectrum fail to add to its lighting. All the colors of the spectrum shining together produce what is called "white" light daylight. As a matter of fact, that "white" light is slightly yellowish, and direct sunlight shining upon a white surface is decidedly orange-yellow. The peculiarity of the pigment on the surface of an object determines what colors of the spectrum can light it. The various

paint pigments are responsible for the fact that the various colors differ in texture; many of them can be differentiated by sensitive finger-tips.

Colors are in *color-harmony* when they are blood relations, and colors are in *color-contrast* when they are not blood relations. For instance, red is in color harmony with purple because red is a part of the mixture which is purple, or red plus blue. And red is in color-contrast with green because red has no part in the mixture which is green, or yellow plus blue.

Theoretically, all the colors of the spectrum can be obtained by various mixtures of the primary pigments, red, yellow and blue, but lemon-yellow mixed with rose-madder to produce orange succeeds only in making an orange which is lacking in brilliance, so that the services of the chemist are required to manufacture orange pigment of a more brilliant quality (cadmium or chrome). However, in general the three *primaries*, with the colors that can be mixed in their various combinations, nearly suffice to furnish the painter of pictures and the house-painter with all that he requires.

The best-known present-day painters employ a palette consisting mainly of zinc white, lemon-yellow, or cadmium yellow light, yellow ochre, cadmium orange, vermilion, rose madder, or Alizarin crimson or Venetian red, cobalt blue, ultramarine blue, emerald green and raw or burnt umber. Only a few of the experienced painters use black.

The essential colors for the house-painter are white lead, zinc white, lemon yellow, yellow ochre, raw sienna, light red, vermilion, rose madder, ultramarine blue, Prussian blue, emerald green, raw umber and black.

The pigments manufactured from coal tar and used for dyeing and printing offer a great variety of hues with a long list of names, many of them known by numbers, but they are not sufficiently permanent to be used by painters. J. C. C.

BIBLIOGRAPHY.—Bonnie E. Snow and H. B. Froelich, *Theory and Practice of Color*, 1918; J. C. Chase, *An Artist's Talk: About Colors*, 1930.

COLORADO, one of the Rocky Mountain states of the United States, popularly called the "Centennial State." It is situated between 37° and 41° N. lat. and 102° and 109° W. long. On the north it is bounded by Wyoming and Nebraska, on the east by Nebraska and Kansas, on the south by Oklahoma and New Mexico, and on the west by Utah. Colorado comprises an area of 103,948 sq. mi. of which 290 sq. mi. are water surface. The state is rectangular in shape, with an extreme length of 375 mi. and an extreme width of 276 mi. In size it ranks seventh among the states of the Union.

Surface Features. Colorado is divided into three distinct topographic zones. The eastern plains occupy about two-fifths of the state and the remainder is almost equally divided between the Rocky Mountain and Colorado plateaus. The surface has a mean elevation above sea level of 6,800 ft., the highest average of any state in the Union. Mt. ELBERT, 14,420

ft., in Lake Co. is the highest point, and the Arkansas River in Prowers Co., 3,350 ft., the lowest.

The eastern plains come within the semi-arid Great Plains which extend from the Canadian border into Texas. On the Kansas-Colorado border their elevation



COLORADO STATE SEAL

is about 4,000 ft. which increases to 6,500 ft. at the mountain front. The area near the Kansas border belongs to the High Plains, a remarkably flat range unbroken by erosion, and between them and the mountains is the Colorado Piedmont, a section where the sedimentary mantle has been worn away exposing the underlying rocks. Towards the southern border the Piedmont Region

gives way to the Raton Mesa and Park Plateau, the latter distinguished by the twin Spanish peaks. The Arkansas and South Platte rivers rise in the mountains and cut shallow valleys across the eastern plains.

The Rocky Mountain zone is a complex of individual ranges. Facing the eastern plains is the Front Range extending from beyond the Wyoming line southward almost to the Park Plateau. Among its most lofty peaks are GRAYS, 14,274 ft., Torreys, 14,264 ft., LONGS, 14,255 ft., and the celebrated Pikes Peak, 14,109 ft.

West of the Front Range is the Sawatch system extending from beyond the Wyoming line through Colorado into New Mexico. It is made up of the Park Range and Gore Mountains to the north, the Sawatch Mountains in the middle, and the Sangre de Cristo Range to the south. Between the Front and Park ranges are North, Middle and South Parks. North and South Parks are level expanses 8,000 to 10,000 feet high and between them is Middle Park, a series of valleys and mountain ridges of considerable height. The towering Sawatch Mountains contain Mt. ELBERT, 14,420 ft. and Mt. MASSIVE, 14,404 ft., the two highest peaks in the state; the Mountain of the Holy Cross and the Collegiate group, all over 14,000 ft. See HOLY CROSS, MOUNTAIN OF THE.

West of the Sangre de Cristo Range lies the great floor-like San Luis Valley, 7,000 to 8,000 ft. above sea level, and beyond it the San Juan Mountains, a rugged mass containing the Needle Peaks, the most precipitous in the state.

THE CONTINENTAL DIVIDE follows a very irregular course through the Colorado Rockies and forms the watershed separating the headstream of the Colorado River on the west, and the Arkansas, North Platte, South Platte and Rio Grande rivers on the east.

The western part of the state belongs to the Colorado plateaus, a physiographic province covering also eastern Utah, northern Arizona and northwestern New Mexico. The province as a whole varies in elevation from 5,000 ft. to 11,000 ft., between which

there are plateaus of all heights, shapes and descriptions. Some are fairly level or sloping, others are cut into gigantic steps or terraces. Many have isolated mountain peaks rising from their bases. The valleys which separate them are usually steep river canyons.

In western Colorado the chief plateau divisions are the Grand Mesa between the Colorado and Gunnison rivers, the Uncompahgre with a summit level of nearly 10,000 ft. between the Uncompahgre and San Miguel rivers, the Dolores between the Dolores and San Miguel rivers, the Book and White plateaus north of the Colorado River, and the Mesa Verde in southwestern Colorado. The latter is 8,000 ft. above sea level with a generally regular north-facing escarpment 2,000 ft. high overlooking a lower plateau. On the south it is gutted by canyons leading to the Mancos River. Mesa Verde is noted for the ancient cliff dwellings in its canyon walls.

Colorado provides some of the most magnificent scenery in the western United States. It has 46 mountain peaks rising over 14,000 ft. in height, many of which are capped by perennial snow and ice packs. Active glaciers occur on Arapahoe and Navajo peaks in the Front Range, where there are also hundreds of lakes in the ice-carved cirques of the higher formations. Conspicuous features of the plateau regions are the Black Canyon of the Gunnison River with the Curicanti Needle standing like a sentinel at its entrance; the lakes and towering forests of the Grand Mesa and the brilliantly colored Dolores formations. The latter consist of rock layers which because of their uneven resistance to erosion have been cut into spires and turrets and caverns.

Climate. Owing to its high mountains, broad plains, and extensive valleys, Colorado exhibits a diversified, but usually mild and healthful climate. The mean annual temperature for the state is 44.8° F. At Denver the average for January is 29.8° F. and for July 72.2° F. During the period, 1888-1930, the highest temperature recorded in Colorado was 115° F. and the lowest, -54° F. The average annual precipitation is 17.4 in. including 69 in. of snow. There are about 157 days at Denver in the average growing season. Because the atmosphere is dry and light with a large percentage of clear days, Colorado ranks high as a health resort.

Forests and Parks. The forests on the eastern slope of the Rocky Mountains begin at an altitude of about 6,000 ft. and continue to the timber line which has an average elevation of 11,500 ft. The lower foothills are covered with a more or less open forest of rock pine and Douglas fir with a mixed growth of narrowleaf cotton wood, box elder, willow, thornapple, wild plum and chokecherry along the streams in the canyons. In the lower mountain zone which extends from about 8,000 to 11,000 ft. the forest is a mixture of pines, spruce, Douglas fir and aspen or, in some instances an almost pure stand of lodgepole pine. Engelmann spruce is the principal tree in the upper mountain zone with alpine fir, lodgepole and

limber and bristlecone pine as secondary species. The mountain ranges of western Colorado are covered with pine forests and on the high plateau areas of this section of the state are extensive regions of pinyon pine and cedar. The present forest area of Colorado is estimated at 8,000,000 acres of which about half is virgin timber. The fifteen national forests in Colorado covered in 1930 a total net area of 13,330,832 acres or more than one-fifth of the land area and are extensively developed for camping and other recreational use. A system of municipally owned mountain parks has been established by Denver, Colorado Springs and other cities. ROCKY MOUNTAIN NATIONAL PARK contains several exceedingly beautiful ones. These parks are usually located in high valleys and are also developed for camping and hiking. The largest of these are North Park, South Park, Middle Park, and San Luis Park. Colorado has no state-owned game preserves, but a number of preserves of large area providing protection for bison, buffalo, elk, antelope, mountain sheep and smaller game animals and birds have been established, principally on National Forest land. MESA VERDE NATIONAL PARK adjoins the Ute Indian reservation in the extreme southwestern corner of the State. Among other interesting scenic features in Colorado are the Yucca House, Hovenweep, Colorado, Holy Cross and Wheeler National Monuments. See separate articles on these subjects.

Minerals and Mining. Colorado is one of the outstanding mineral regions of the United States, containing immense ore deposits that yield gold, silver, lead, zinc and copper, and also extensive beds of bituminous coal, the most productive west of the Mississippi River, underlying an area of some 18,000 sq. mi. Among numerous other mineral resources are petroleum, asphalt, building stones, gem stones, and various ores of the rarer metals, as molybdenum, tungsten, vanadium, and especially uranium which until 1922 constituted the world's chief source of radium.

The early settlement and economic development of the state resulted directly from the operation of great gold and silver mines, though rich finds of placer gold gave the first impetus. From 1878 to 1905 the immense silver mines at Leadville yielded a total product valued at \$325,000,000. Gold production in the Cripple Creek mines from 1890 to 1914 amounted to upwards of \$300,000,000. After 1915 the production of precious metals declined while that of coal and various other mineral products increased.

With mineral productions for 1929 amounting to \$55,331,911 Colorado stood twenty-first among the states, ranking first in molybdenum, third in fluorspar, fourth in gold, sixth in silver and lead, and eighth in coal, zinc and copper.

The outstanding product was coal, 9,920,741 tons, valued at \$26,254,000. Other important products were gold, 213,690 oz., \$4,417,358; zinc, 29,431 tons, \$3,884,826; clay products, \$3,117,064; lead, 24,445 tons, \$3,080,064; petroleum, 2,358,000 bbls., \$2,380,000; sil-

ver, 4,397,377 oz., \$2,343,802, and copper, \$1,697,951. Among minor products were natural gas, sand and gravel, limestone, granite, clay, tungsten ore, natural gasoline, molybdenum and fluorspar.

During 1929 343 mines and quarries gave employment to 15,567 persons who received \$24,680,653 in salaries and wages.

Soil. Alluvial deposits in limited areas in the valleys of the larger rivers comprise the most fertile soils found in Colorado. In the lower lands of the eastern part of the state the soils are generally sandy, covered by a rich humus. Throughout Colorado both clayey and siliceous soil formations are found.

Agriculture. Grain, alfalfa, potatoes and sugarbeets are the chief crop products.

In 1930 28,876,171 ac. or 43.5% of the entire land area was in farms, 59,956 in number, with an average size per farm of 481.6 ac. and an average value per acre of \$21.79. Of the farm area 8,448,684 ac. was crop land and 19,338,377 ac. pasture land. The total value of farm property was \$795,387,096, of which \$629,346,675 was represented by land and buildings; \$50,241,437, by implements and machinery; and \$115,798,984, by domestic animals.

According to the census of 1930 Colorado produced in 1929 field crops to the value of \$124,762,428, ranking twenty-ninth among the states. It stood first in sugar beets, fourth in cantaloupes, sixth in pears, cherries and lettuce, and eighth in potatoes and barley. The leading crops were grain \$46,073,831; hay, 2,562,530 tons, \$29,946,784, including alfalfa 1,678,976 tons; vegetables (including potatoes), \$23,708,982; sugar beets, 2,620,823 tons, \$18,162,303, and fruits, \$5,699,950. The chief grains were corn 18,594,210 bu., wheat 17,332,160 bu., barley 10,706,025 bu., and oats 4,704,838 bu. Potatoes, 14,649,446 bu. grown on 89,692 ac., were valued at \$16,281,868; among the other vegetables were dry onions, \$869,374, and cantaloupes, \$803,260. The leading fruits were apples, 2,251,330 bu.; peaches, 953,175 bu., and pears, 527,900 bu. Farm products sold by cooperative marketing dropped from \$9,303,346 in 1919 to \$8,399,417 in 1929. Farm machinery and equipment in 1930 included 52,258 automobiles, 16,918 motor trucks, 13,334 tractors, 3,299 electric motors, and 11,470 stationary gas engines.

Irrigation. Colorado ranks second to California in the extent and value of irrigated farms and in investments in irrigation enterprises. Irrigation has been more or less developed in all sections of the state, some 60 counties being separately reported in the Census of 1930. The most extensive irrigated areas lie in the drainage basins of the South Platte, Arkansas, Rio Grande and upper Colorado rivers, with their tributaries. Irrigated farms comprised 52% of the number and 61% of the value of all farms in Colorado. About 40% of all crop land is irrigated. The proportion irrigated was 11.8% of the area of all land in farms and 5.1% of the land area of the state.

The total number of irrigated farms was 31,288, with an aggregate area of 10,390,299 ac., of which

3,393,619 ac. were irrigated. Including land and buildings the value of all irrigated farms was \$386,053,889, or an average of \$37.16 per ac. The total investment in irrigation enterprises to 1930 was \$87,603,240, and the average cost of maintenance and operation for 1929 was \$0.85 per ac.

Animal Industry. Cattle- and sheep-raising are the chief livestock interests. According to the census of 1930, Colorado stood ninth among the states in number of sheep on farms and tenth in pounds of wool shorn. The state ranked twentieth in total value, \$115,798,984, of domestic animals on farms. Among these were cattle, 1,453,952, valued at \$72,763,997; sheep, 2,505,159, \$18,581,744; horses, 329,344, \$13,662,635; mules, 29,124, \$1,624,898; swine, 462,301, \$5,873,968, and goats, 30,512, \$139,884.

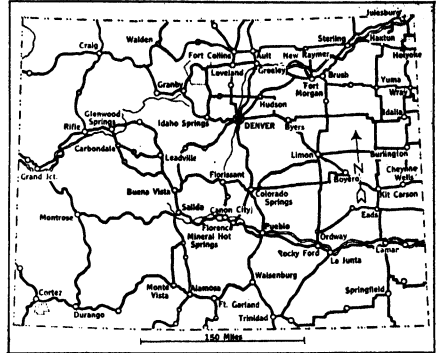
Of the cows on farms 481,377 were kept mainly for beef production and 266,194 mainly for milk production. In 1929, 121,905,777 gals. of milk were produced; the total value of dairy products sold was \$14,606,564. The value of all poultry raised was \$6,307,990, chiefly chickens, 6,333,339 in number valued at \$4,768,549, and turkeys, 547,789, \$1,443,913. The chickens sold, 2,226,813 in number, were valued at \$1,773,064. Of 27,343,356 doz. chicken eggs produced 17,572,775 doz., valued at \$4,713,227, were marketed. The wool clip, 11,678,297 lbs., was valued at \$3,422,582. Honey, amounting to 3,509,510 lbs. valued at \$396,270, was produced from 67,289 hives.

Fisheries. Colorado has no commercial fisheries, but the lakes and streams of the state are alive with trout and other game fish. In 1930, the state issued 114,538 fishing licenses, for which \$210,382.75 was received in fees. Fourteen hatcheries were operated by 28 employees, on which \$65,132.78 was spent. The output was 27,000,000 trout. The United States Bureau of Fisheries cooperates with the Forest Service in stocking the waters of the national forests for the benefit of visiting tourists, and in 1930 planted the following numbers of fingerlings and yearlings in Colorado waters: silver salmon, 200,000; steelhead salmon, 350,000; rainbow trout, 1,257,500; black spotted trout, 65,800; Loch Leven trout, 1,327,000; lake trout, 135,000; brook trout, 4,041,300; crappie, 7,500; bass, 6,800; and yellow perch, 5,425.

Transportation. There are no navigable rivers in Colorado. However, it has the largest railway mileage of any Rocky Mountain state. The first railroads were completed in 1870, when the Denver Pacific, from Cheyenne, Wyo., to Denver, and the Kansas Pacific, from Kansas City were completed. The Denver & Rio Grande followed in 1871, stimulating the earlier development of the state. In 1930 the total railway mileage was 4,966. The principal systems include the Missouri Pacific, the Rock Island, the Burlington, the Santa Fé and the Colorado & Southern.

On Jan. 1, 1930, there were 76,131 mi. of highways, including 7,157 mi. of surfaced roads and 4,192 mi. of state highways. The total highway expenditure during 1929 was \$11,797,571, of which the state paid \$6,361,665 and county and local governments \$5,-

435,906. The state gasoline tax produced a gross revenue of \$6,144,826 in 1930. Motor vehicle registrations were 308,509 in 1930 compared with 240,097 in 1925. Motor truck registrations of 31,662 in 1930 indicated an increase of more than 70% in trucking



COLORADO STATE ROADS

facilities over 1925, when 18,584 were registered. Bus transportation practically doubled during this period, 1,504 buses operating in 1930, compared with 774 in 1925.

Manufactures. The manufacturing industries of Colorado have arisen mainly in connection with the development of the state's mineral and agricultural resources, especially coal mining, sugar beet growing and cattle raising.

According to the Census of 1930 Colorado with manufactures for 1929 valued at \$306,071,031 stood thirty-fourth among the states. Its 1,548 establishments gave employment to 6,223 officers and employees, who received \$13,580,172 in salaries and to 32,890 wage earners, who were paid \$43,640,403 in wages. These factories used a total of 233,726 horse power, expended \$13,557,366 for fuel and power, and \$170,182,187 for material and supplies, and added by the process of manufacture \$122,331,478 to the value of their output.

The principal manufactures in order of their approximate value were iron and steel, including pig iron, rolling mill and structural products, \$50,000,000; beet sugar, \$40,000,000; packed meats, \$36,700,000; printing and publishing, \$18,000,000; flour, \$13,750,000; steam railway car shop construction and repairs, \$12,900,000; bread and bakery products, \$11,750,000; foundry and machine shop products, \$10,700,000; and butter, \$9,850,000.

The chief manufacturing centers are Denver with an output of \$144,664,746 and Pueblo (including Pueblo Co.) with products amounting to \$55,997,697; the former contributed 47% and the latter 18% of the total manufactures of the state.

Commerce. According to the census of 1930, there were in 1929 2,075 wholesale establishments in Colo-

rado, with total sales of \$539,625,526. These organizations gave full-time employment to 14,628 men and women, whose salaries aggregated \$23,947,236. The chief wholesaling center is Denver.

The total sales of the 14,063 retail stores amounted to \$497,852,191. Sales per store averaged \$35,402; sales per capita were \$480.65.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
Automotive	3,000	\$116,028,283	23.30
Food	3,493	115,857,617	23.28
General Mdse.	1,253	89,011,110	17.87
Lumber	776	30,711,272	6.17
Apparel	806	29,083,161	5.83
Furn & Household	408	19,989,254	4.01
All other stores	4,327	97,171,494	19.54
Total, all stores	14,063	\$497,852,191	100.00

Finance and Banking. The assessed value of all Colorado property in 1929 was \$1,586,839,013. The total bonded debt on June 30, 1930 was \$9,009,100 against which there were sinking funds of \$643,014. Total revenue receipts in 1928 were \$18,808,280, total expenditures \$17,531,849. The chief sources of income were property and special taxes, \$7,520,000 and licenses, \$6,269,425. This item included the motor vehicle tax and a gasoline sales tax aggregating \$4,118,399. The principal expenditures were for highways, \$7,067,639; permanent improvements, \$5,454,989; and educational aid, \$838,110.

There were 260 banks in Colorado in 1930, of which 116 were national banks and 144 trust companies and state banks. Their aggregate capitalization was \$19,007,800; their surplus and undivided profits \$18,458,000. Their total resources the same year were \$341,589,000; loans and discounts aggregated \$152,705,000. Demand and time deposits including postal savings totaled \$269,087,000. Per capita demand and time deposits were \$259.49; per capita savings deposits \$104.22. The total savings of \$108,079,000 were owned by 224,868 depositors. National bank circulation aggregated \$4,355,000.

Government. The legislative body consists of a senate composed of 35 members and a house of representatives of 65 members, the former elected for terms of four years and the latter for terms of two years. They meet in biennial sessions of unlimited duration. The executive officers are a governor, lieutenant governor, secretary of state, auditor, treasurer, attorney-general and superintendent of public instruction, each elected for two-year terms, the auditor and treasurer being ineligible for re-election. The governor is elected for a term of two years and receives a salary of \$5,000 per year. He has the right of veto, but a two-thirds vote of both houses overrides his veto. Judiciary power is vested in a supreme court consisting of seven judges elected for 10-year terms with salaries of \$5,000 per annum; in a court of appeals; in district and county courts and in justices of the peace.

Social Welfare Institutions. Colorado was one of the first states to introduce special juvenile courts

and the parole system. There is an industrial school for girls at Mt. Morrison and one for boys at Golden. There also is a children's home at Denver. At Ridge and Grand Junction are homes for mental defectives. The state prison is at Canyon City and the reformatory at Buena Vista. At Monte Vista is a soldiers' and sailors' home, and at Pueblo the state hospital for insane. An industrial workshop for the blind is maintained at Denver.

Education. The first school, operated through private subscriptions, was opened in Denver in 1859 with 13 children in attendance. A schoolhouse was built at Boulder in 1860, and the first public school was established there. When Colorado was organized as a territory in 1861, the territorial legislature passed the first school law. By 1929 there were 691 public elementary, 315 senior high, 162 junior high, and 2,107 rural schools, having in all 256,134 enrolled pupils and 9,555 teachers. Compulsory school laws require children from 8 to 16 years of age to attend the full school year.

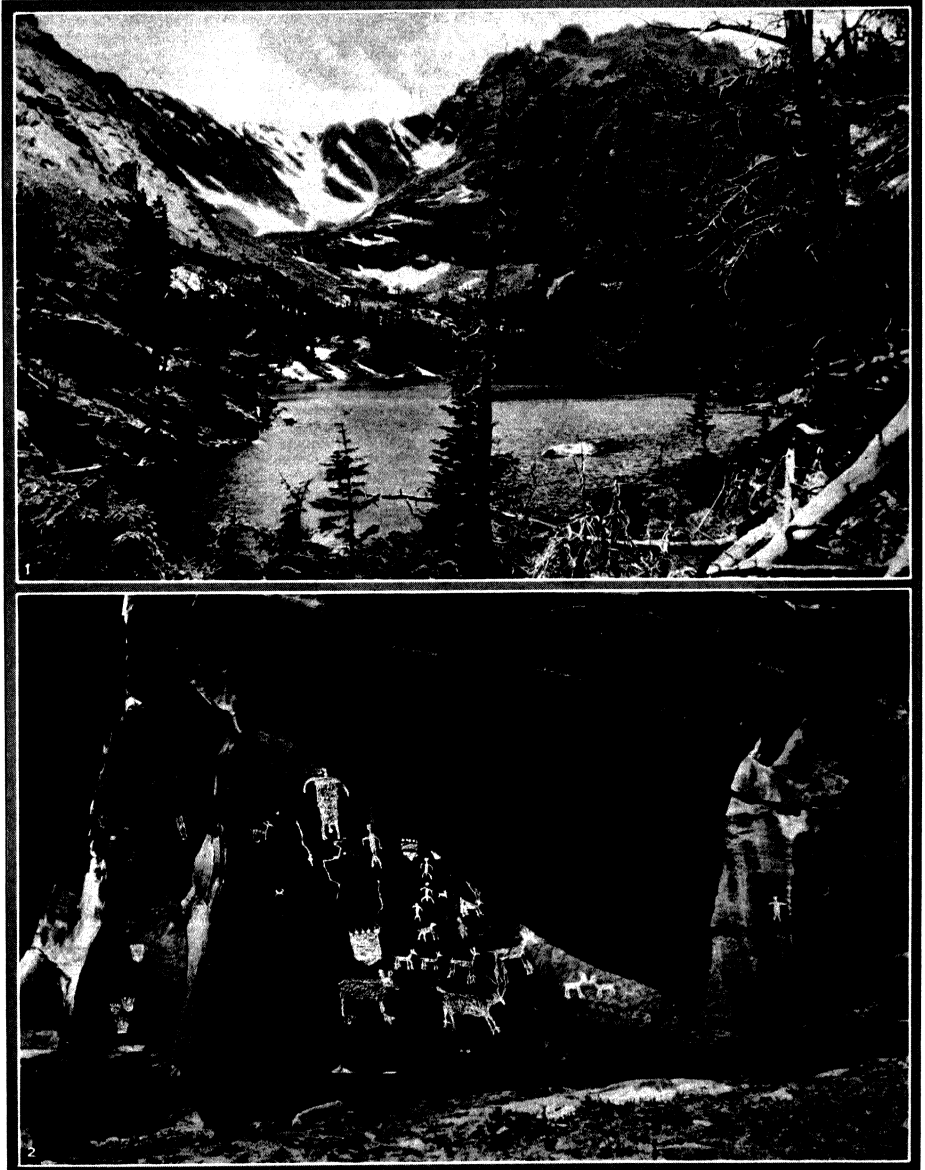
The number of persons from 5 to 20 years of age attending school in 1930 was 231,728, or 73.2% of the population within the ages specified, as compared to 193,482, or 69.6%, in 1920. Persons unable to read and write in 1930 numbered 23,141, or an illiteracy percentage of 2.8, as compared to 24,208 illiterates, or 3.2%, in 1920.

The state institutions for higher education include the University of Colorado at Boulder, the School of Mines at Golden, the Agricultural College at Fort Collins, Colorado Teachers' College at Greeley, Western State College at Gunnison, and Adams State Normal School at Alamosa. There is a government Indian school at Grand Junction. Other important educational institutions are Colorado College at Colorado Springs, Colorado Woman's College and Regis College, both at Denver, and the University of Denver. The Colorado State Library Commission has its headquarters in the public library at Denver.

Population. In 1930 Colorado ranked thirty-third among the states with a population of 1,035,791 or an average of 10.0 per square mile, an increase of 96,162 or 10.2% over 1920. The population rose from 34,277 in 1860, 539,700 in 1900, 799,024 in 1910, to 939,629 in 1920. In 1930 there were 961,117 or 92.8% whites, 57,676 or 5.6% Mexicans and 11,828 or 1.1% Negroes. Of the whites 875,711 were native born and 85,406 were foreign born. The urban population was 519,882 or 50.2% of the total, an increase of 66,623 or 14.7% from 1920; the rural population was 515,909 or 49.8% of the total, an increase of 29,539 or 6.1% since 1920. There were in 1930 three cities with a population of 15,000 and upwards: Denver, 287,861; Pueblo, 50,096; Colorado Springs, 33,237.

Occupations. In 1930 402,867 persons, or 38.9% of the population, were gainful workers 10 years old or older; 79.9% of these were males and 20.1% were females; 82.1% were native white; 11.5% foreign-born white; 1.5% Negro, and 4.8% other races. Among the principal occupations, with number of

COLORADO



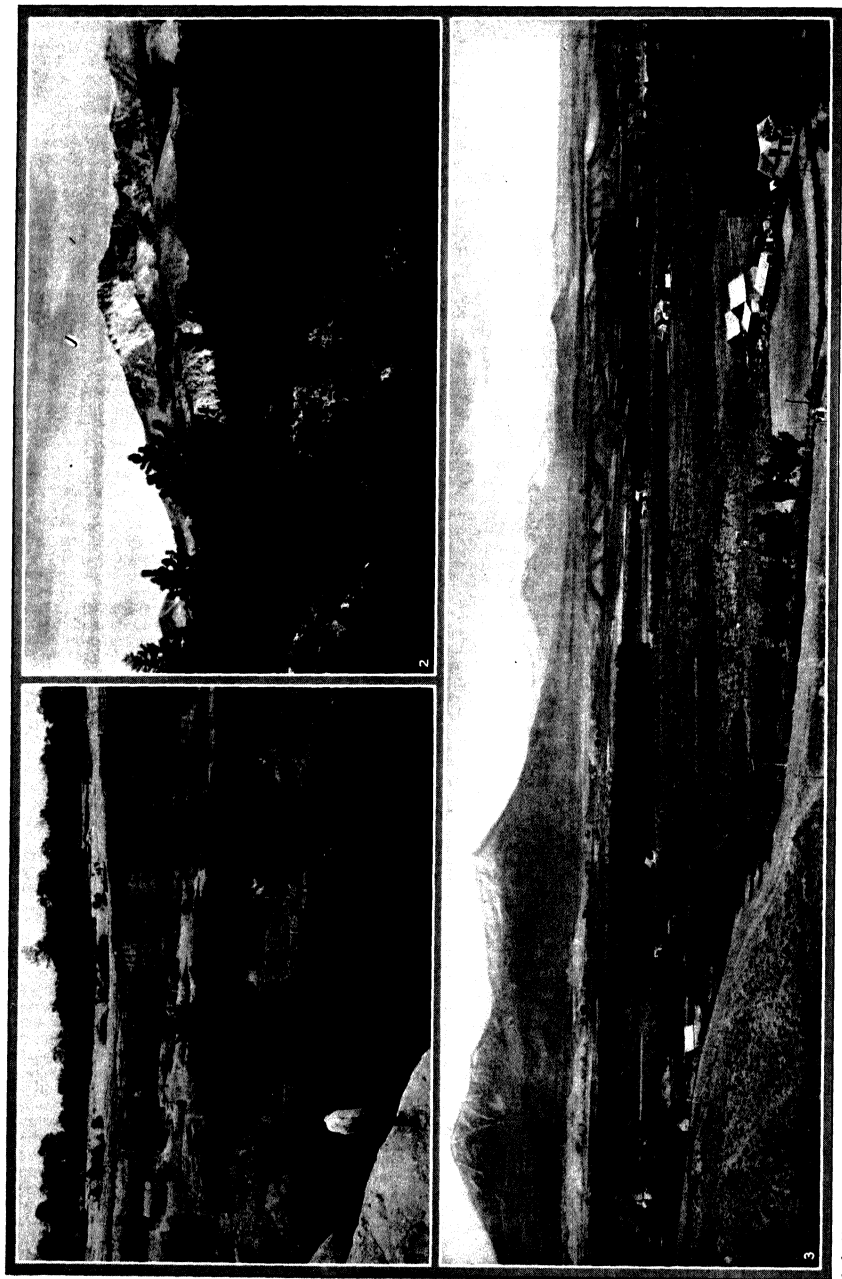
1. COURTESY THE COLORADO ASSN., PHOTO FROM GRACECRAFT SHOP; 2. DELTA CHAMBER OF COMMERCE

MOUNTAIN LAKE AND INDIAN PICTURE ROCKS OF COLORADO

1. Loch Vale, Rocky Mountain National Park.

2. Symbols of a primitive people—Indian picture rocks near Delta.

COLORADO

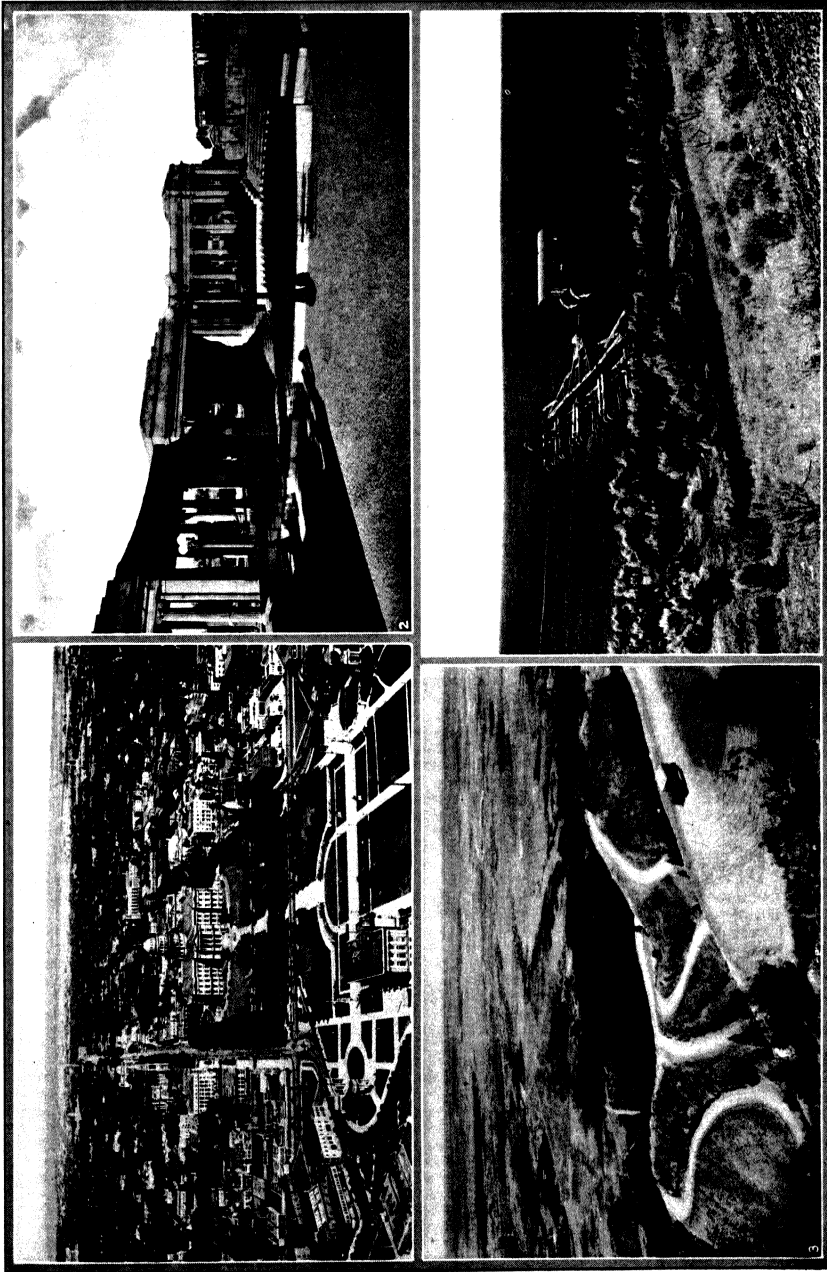


1, 2, COURTESY THE COLORADO ASSN.; 3, CHAMBER OF COMMERCE, DELTA, COLO.

COLORADO'S TOWERING MOUNTAINS AND FERTILE VALLEYS

1. Spruce Tree House, Mesa Verde National Park. It is one of the largest cliff dwellings in the Southwest.
2. North slopes of Pike's Peak near Colorado Springs.
3. North Fork Valley.

COLORADO



SCENES OF INTEREST IN COLORADO

1. Airplane view of Denver, showing the State Capitol.
2. The beautiful Greek theater in the civic center of Denver.
3. Spiral Shelves, Broadmoor-Cheyenne Highway, Colorado Springs.
4. Preparing the ground for wheat on one of the large Colorado farms.

1, 2, 3, COURTESY THE COLORADO ASSN.; 1, PHOTO FROM H. L. STANLEY; 4, CATERPILLAR TRACTOR CO.

COLORADO

Area 103,948 sq. mi.
Pop. 1,035,791

PRINCIPAL CITIES

Pop.—Thousands

- 1 Aguilar... 0.16
- 1 Akron... 0.20
- 1 Alamosa... 0.12
- 1 Arvada... 0.14
- 1 Aurora... 0.15
- 1 Boulder... 0.14
- 1 Brighton... 0.15
- 1 Brush... 0.19
- 1 Burlington... 0.23
- 1 Canon City... 0.14

- 1 Center... 0.11
- 33 Colorado Springs... 0.15
- 1 Craig... 0.07
- 1 Crested Butte... 0.08
- 1 Cripple Creek... 0.14
- 1 Delagua... 0.16
- 1 Del Norte... 0.10
- 3 Delta... 0.15
- 288 Denver... 0.15
- 5 Durango... 0.15
- 1 Eaton... 0.16
- 1 Edgewater... 0.15
- 1 Englewood... 0.16
- 2 Florence... 0.14
- 11 Ft. Collins... 0.14
- 4 Ft. Morgan... 0.15
- 1 Fowler... 0.18
- 1 Fruita... 0.13
- 2 Glenwood Springs... 0.07
- 2 Golden... 0.14
- 10 Grand Junction... 0.14

- 12 Greeley... 0.16
- 1 Gunnison... 0.08
- 1 Haxton... 0.22
- 1 Holly... 0.24
- 1 Holyoke... 0.23
- 1 Idaho Springs... 0.15
- 1 Julesburg... 0.23
- 2 Lafayette... 0.14
- 7 La Junta... 0.19
- 4 Lamar... 0.22
- 3 Las Animas... 0.16
- 4 Leadville... 0.11
- 1 Limon... 0.10
- 2 Littleton... 0.15
- 2 Longmont... 0.14
- 2 Louisville... 0.14
- 2 Loveland... 0.14
- 1 Manassa... 0.12
- 1 Manitou... 0.15
- 1 Meeker... 0.16
- 3 Monte Vista... 0.11

- 4 Montrose... 0.11
- 1 Oak Creek... 0.09
- 1 Ordway... 0.19
- 1 Paonia... 0.16
- 2 Primor... 0.16
- 50 Pueblo... 0.16
- 1 Rifle... 0.16
- 3 Rocky Ford... 0.16
- 1 Sagua... 0.11
- 5 Salida... 0.12
- 1 Silverton... 0.10
- 1 Springfield... 0.22
- 2 Starkville... 0.16
- 1 Steamboat Springs... 0.09
- 7 Sterling... 0.20
- 12 Trinidad... 0.16
- 1 Victor... 0.14
- 6 Walsenburg... 0.14

- 2 Windsor... 0.15
- 2 Wray... 0.23
- 1 Yuma... 0.22

- 9 Antonito... 0.11
- 7 Aspen... 0.19
- 17 Aurora... 0.14
- 8 Berthoud... 0.14
- 8 Buena Vista... 0.11
- 8 Capulin... 0.11
- 6 Cheyenne Wells... 0.23
- 9 Cortez... 0.13
- 9 Erie... 0.14
- 7 Hugo... 0.19
- 8 Johnstown... 0.15
- 8 La Veta... 0.14
- 4 Minturn... 0.14
- 7 Ouray... 0.16
- 7 Ovid... 0.23
- 8 Pagosa Springs... 0.18
- 9 Palisade... 0.14
- 7 Rockvale... 0.14
- 9 Walsen... 0.15

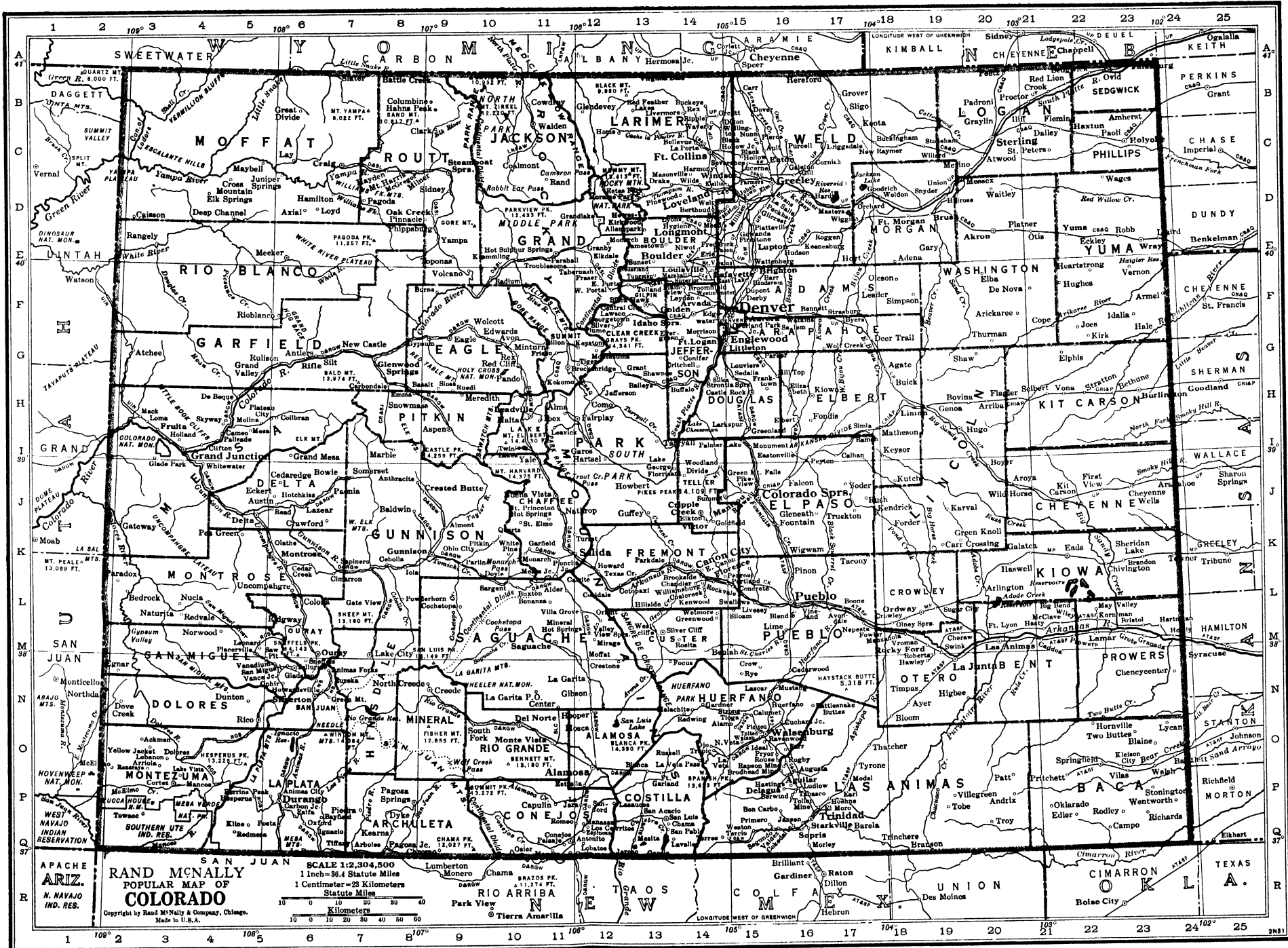
- 9 Pop.—Hundreds
- 9 Antonito... 0.11
- 7 Aspen... 0.19
- 17 Aurora... 0.14
- 8 Berthoud... 0.14
- 8 Buena Vista... 0.11
- 8 Capulin... 0.11
- 6 Cheyenne Wells... 0.23
- 9 Cortez... 0.13
- 9 Erie... 0.14
- 7 Hugo... 0.19
- 8 Johnstown... 0.15
- 8 La Veta... 0.14
- 4 Minturn... 0.14
- 7 Ouray... 0.16
- 7 Ovid... 0.23
- 8 Pagosa Springs... 0.18
- 9 Palisade... 0.14
- 7 Rockvale... 0.14
- 9 Walsen... 0.15

- 9 Pop.—Hundreds
- 9 Antonito... 0.11
- 7 Aspen... 0.19
- 17 Aurora... 0.14
- 8 Berthoud... 0.14
- 8 Buena Vista... 0.11
- 8 Capulin... 0.11
- 6 Cheyenne Wells... 0.23
- 9 Cortez... 0.13
- 9 Erie... 0.14
- 7 Hugo... 0.19
- 8 Johnstown... 0.15
- 8 La Veta... 0.14
- 4 Minturn... 0.14
- 7 Ouray... 0.16
- 7 Ovid... 0.23
- 8 Pagosa Springs... 0.18
- 9 Palisade... 0.14
- 7 Rockvale... 0.14
- 9 Walsen... 0.15

- 9 Pop.—Hundreds
- 9 Antonito... 0.11
- 7 Aspen... 0.19
- 17 Aurora... 0.14
- 8 Berthoud... 0.14
- 8 Buena Vista... 0.11
- 8 Capulin... 0.11
- 6 Cheyenne Wells... 0.23
- 9 Cortez... 0.13
- 9 Erie... 0.14
- 7 Hugo... 0.19
- 8 Johnstown... 0.15
- 8 La Veta... 0.14
- 4 Minturn... 0.14
- 7 Ouray... 0.16
- 7 Ovid... 0.23
- 8 Pagosa Springs... 0.18
- 9 Palisade... 0.14
- 7 Rockvale... 0.14
- 9 Walsen... 0.15

- 9 Pop.—Hundreds
- 9 Antonito... 0.11
- 7 Aspen... 0.19
- 17 Aurora... 0.14
- 8 Berthoud... 0.14
- 8 Buena Vista... 0.11
- 8 Capulin... 0.11
- 6 Cheyenne Wells... 0.23
- 9 Cortez... 0.13
- 9 Erie... 0.14
- 7 Hugo... 0.19
- 8 Johnstown... 0.15
- 8 La Veta... 0.14
- 4 Minturn... 0.14
- 7 Ouray... 0.16
- 7 Ovid... 0.23
- 8 Pagosa Springs... 0.18
- 9 Palisade... 0.14
- 7 Rockvale... 0.14
- 9 Walsen... 0.15

- 9 Pop.—Hundreds
- 9 Antonito... 0.11
- 7 Aspen... 0.19
- 17 Aurora... 0.14
- 8 Berthoud... 0.14
- 8 Buena Vista... 0.11
- 8 Capulin... 0.11
- 6 Cheyenne Wells... 0.23
- 9 Cortez... 0.13
- 9 Erie... 0.14
- 7 Hugo... 0.19
- 8 Johnstown... 0.15
- 8 La Veta... 0.14
- 4 Minturn... 0.14
- 7 Ouray... 0.16
- 7 Ovid... 0.23
- 8 Pagosa Springs... 0.18
- 9 Palisade... 0.14
- 7 Rockvale... 0.14
- 9 Walsen... 0.15



RAND McNALLY
POPULAR MAP OF
COLORADO
Copyright by Rand McNally & Company, Chicago.
Made in U.S.A.

workers, were farmers, 58,333, and farm wage workers, 38,286; salespersons, 13,949 men and 5,113 women; clerks, 10,124 men and 6,008 women; retail dealers, 14,705; servants, 3,139 men and 10,840 women; factory operatives, 9,179 men and 3,120 women; school-teachers, 1,910 men and 9,430 women; coal mine operatives, 10,134; chauffeurs, 7,263; factory laborers, 7,997, and stenographers, 329 men and 6,467 women.

HISTORY

Colorado was acquired by three cessions of territory. The portion east and north of the Arkansas River was included in the Louisiana Purchase, 1803; the section west of the Arkansas and the Rio Grande was part of the settlement with Mexico in 1848; and a small strip in the south was ceded by Texas in 1850. In the southern and southwestern parts of the state are prehistoric remains of great archaeological interest that are a part of the story of the CLIFF DWELLERS, but the northern part was roamed over by the nomadic Indian tribes of the plains. The first Europeans to see the country were Spaniards from Mexico seeking gold and silver and hoping to convert the Indians to Christianity. Coronado probably entered it in 1540. There was Spanish exploration in the southern part in 1776 by the friars Escalante and Dominguez, who were searching for a route through the mountains to northern California. In 1799 the fur traders, Maisonneuve and Perneloupe, camped on the present site of Denver. The first American to enter the region was James Purcell, a fur trader, in 1806. In the same year Capt. ZEBULON M. PIKE of the United States Army explored in the eastern part for the United States, mapping the Arkansas and Red Rivers and discovered the famous peak that bears his name. Another Government exploring expedition in 1819-20 was headed by Maj. S. H. Long, who investigated the South Platte and the Arkansas Rivers and discovered the mountain peak named for him. During the next 20 years trading posts and private forts were maintained in various sections, and in 1841 the first overland emigrants to the Pacific Coast crossed Colorado. JOHN C. FRÉMONT, guided by KIT CARSON, explored much of the territory for the United States in 1842-45. After the rich discoveries of gold in 1858 and following years, emigrants and prospectors rushed into the region in large numbers. The first permanent settlement was made at Denver under its present name in 1858. Numerous other towns were established during the next year or two. Colorado was then a part—Arapahoe Co.—of Kansas Territory, and the territorial government of Kansas functioned within it. But the people of the county organized it as the Territory of Jefferson. Local "peoples' courts" still more complicated the situation, which was finally cleared up when Congress in February, 1861, organized a legal territorial government with the capital first at Colorado City, the next year at Golden, and in 1868 at Denver, where it has since remained. Colorado was admitted to statehood Aug. 1, 1876, its population by the 1880 census being 194,327. The state adopted its

first and only constitution in 1876. It has been liberalized and modernized by many amendments, among them those providing for the initiative and referendum. During the border period Colorado was the scene of much Indian warfare. Although Republican in the presidential years 1920, 1924, and 1928, Colorado in 1932 gave its six electoral votes to Roosevelt. Alva B. Adams, Democrat, was elected senator, and Edwin C. Johnson, Democrat, governor.

BIBLIOGRAPHY—J. C. Smiley, *Semi-Centennial History of Colorado* (1913); W. F. Stow, *History of Colorado*, 3 vols. (1918).

COLORADO, UNIVERSITY OF, at Boulder, Col., a coeducational state institution, incorporated by act of the territorial legislature in 1861. In 1876 when Colorado became a state, the university was continued as a state institution and as such received land from Congress. The university comprises colleges of Liberal Arts and Sciences, Commerce, Education, Engineering and Pharmacy, and schools of Social and Home Service, Medicine and Law, the Graduate School, Training School and School for Nurses, several of which are located at Denver. It had productive funds of approximately \$1,750,000 in 1931. The library contains about 225,000 volumes. In 1931-32 there were 3,350 students, and a faculty of 325 headed by Pres. GEORGE NORLIN.

COLORADO COLLEGE, a coeducational institution at Colorado Springs, Col., founded in 1874. It is the oldest institution of higher learning in the state, is privately controlled, and non-sectarian with Congregational affiliations. Its productive funds totaled \$2,472,232 in 1931. There are approximately 93,000 volumes in the library. In 1931-32 there was a student enrollment of 636, and a faculty of 76 headed by Pres. Charles C. Mierow.

COLORADO DESERT, a region in Imperial and Riverside counties, southern California and in Lower California, Mexico, which extends from San Geronio Pass in the north to the head of the Gulf of Lower California. It is 200 mi. long and attains a maximum width of 50 mi. On the west it is bounded by the San Jacinto, Santa Rosa and Peninsula ranges, and on the east by a network of ranges which are a continuation of the San Bernardino Mountains. PALM SPRINGS, the Coachella Valley, Salton Sea, and IMPERIAL VALLEY are the outstanding features of the region. Entering San Geronio Pass at the north, there is first a region of shifting sand dunes where strong winds through the pass and from the surrounding mountains keep the sand in almost constant motion. Palm Springs, famous desert resort, is located in this region. South of the sand dune area is a district which includes the Indio region or Coachella valley, a valuable agricultural district. Here the valley floor is silt-covered and comparatively flat. Vegetation grows with amazing luxuriance and stunted and dwarfed desert plants attain unusual size due to the artesian waters which seep through the clays.

The Salton Sea, a brackish body of water just north of Imperial Valley, is 250 ft. below sea level (U.S.

Geological Survey, 1928). In past geologic ages it was a sink of the Colorado River and attained an area of 2,100 sq. mi. In 1904 it was 280 ft. below sea-level and was about to disappear when, due to efforts to obtain irrigation water from the Colorado River for Imperial Valley, the river broke through into the Salton Sea, seriously threatening the surrounding country and was not stopped until 1907 when it had risen to 244 ft. below sea level and had attained an area of 500 sq. mi. Seven miles west of Imperial Junction in California and also along the western shore of Volcanso Lake in Lower California are groups of mud volcanoes some of which take the form of quite perfect cones with craterlets at the top and give forth gaseous emanations from pools of boiling mud.

Imperial Valley, one of the most highly productive regions in the United States since it has been brought under irrigation, was a delta of the Colorado in past ages and is covered with a fine silt deposited by the river.

The main line of the Southern Pacific railroad passes through the Colorado Desert region following a wagon trail of the mission and pioneer days and the valley is also traversed by motor highways entering both through San Geronio Pass at the north and from Yuma at the southeast.

COLORADO NATIONAL MONUMENT, a region of fantastically eroded and highly colored rocks in west central Colorado. It was proclaimed a national monument May 24, 1911 and is 13,749.47 acres in extent. The rock formation is similar to that of the famous GARDEN OF THE GODS but is on a grander scale and is more picturesque. One gigantic sandstone monolith, known as Independence Rock, is 500 ft. high with a base 250 ft. long and 100 ft. wide. Great rock amphitheaters, caves, passageways, petrified wood and dinosaur tracks are among other features of the monument. A scenic highway, called the Trail of the Serpent, winds its way from the entrance to a summit on the southern boundary affording a splendid panorama of the region. Grand Junction on the Denver and Rio Grande Western railroad, the Pike's Peak Ocean-to-Ocean Highway, the National Roosevelt Midland Trail, and the Rainbow Route are about 8 mi. by automobile road from the monument.

COLORADO POTATO BEETLE. See POTATO BEETLE.

COLORADO RIVER, a river of western United States, rising in Colorado and flowing into the Gulf of California. Its source is in the high peaks of the Rockies of north central Colorado, whence it flows southwestward through western Colorado, southeastern Utah and northwestern Arizona where it turns southward to form the boundary between Arizona on the east and Nevada and California on the west. The great delta at its mouth is in Mexico at the head of the Gulf of California. Its length is approximately 2,000 mi. The upper course, formerly called the Grand River, flows through a succession of canyons, alternating with long narrow valleys. After its junction with the Green River the stream flows continu-

ously through a ragged canyon cut far down into the high plateau regions of Utah and of Arizona where it is known as the Grand Canyon. On its southward course the river flows through a succession of bolsons and short canyons. Its chief tributaries are the Gunnison, Dolores, Green, San Juan, Little Colorado, Virgin, Williams and Gila rivers.

The Colorado is similar to the Nile in that it is a perennial stream flowing through arid regions because of ample supplies at its source; it has an annual flood at a time when the water is useful for irrigation; and it carries a vast quantity of mud and silt. The maximum flow at the mouth is from 70,000 to 110,000 second ft. and the mean volume is 10,700 second ft. The waters of the upper and middle reaches are mostly inaccessible and therefore have little value but the lower course is a source of power and of water for irrigation. Black Canyon directly southeast of Las Vegas, Nev., is the site of the Boulder Dam project, and at a point about 10 mi. below Yuma the Imperial Canal diverts water from the river to irrigate the great Imperial Valley.

COLORADO SPRINGS, a city of central Colorado, the county-seat of El Paso Co., situated about 75 mi. south of Denver. It is served by bus lines and six railroads. There is a municipal airport. The principal local industries are gold refining, coal mining and the manufacture of advertising films. In 1929 the value of manufactured products was about \$5,000,000; the retail trade amounted to \$25,264,053. Located at an altitude of 6,037 ft., with a background of lofty mountains dominated by Pike's Peak, the city is a famous health resort, and attracts many tourists. Among the remarkable scenic features of the surrounding country are the Garden of the Gods, the Cave of the Winds, Seven Falls, the Cheyenne Canyon and Monument Park. According to a legend, Helen Hunt Jackson, the author, is buried near the city, on the slope of Cheyenne Mountain.

In 1870 Gen. W. J. Palmer, president of the Denver and Rio Grande Railway, founded Colorado Springs. The town was laid out in 1871 and incorporated the next year; it was chartered as a city in 1878, and in 1909 was granted a new charter. Pop. 1920, 30,105; 1930, 33,237.

COLORATION, the use of color and color patterns by animals in avoiding enemies or finding mates, the myriad variations and, in some cases, rapid change of these patterns, the chemistry and source of organic pigments and the luster of scales and feathers. Luster is due to reflecting surfaces, such as overlapping layers of translucent material of the scales upon wings of iridescent butterflies, producing this effect through interference of light waves. The brilliant colors of flowers, foliage plants and autumn leaves are due to pigments, or anthocyanins, which are red in acid, blue or green in alkaline or neutral solutions. They absorb heat; leaves colored with anthocyanins are sometimes 2° C. warmer than the green leaves of the same plant. Alpine and arctic plants are rich in anthocyanins and often very brilliant.

Leaf-green, or chlorophyll, important in plant nutrition, occurs in tiny corpuscles called plastids, found also in a few animals, e.g., the fresh water polyp, Hydra. From leaf-green and carotin, a yellow pigment associated with it in plants, come the yellow-green blood pigments of leaf-eating caterpillars. Carotin, named from carrot, gives color to egg yolks and butter. Melanin, a black pigment of animals, comes from tyrosine, a nitrogenous by-product, amino-acid, found in the blood of animals and juices of plants.

Heat and cold, dryness and moisture, have profound effects upon the pigments of animals, as shown by their seasonal varieties. Suppression of pigment in the hollow axis of the hair of mammals, such as the hare or ermine weasel, turns it white, due to reflection of light by the imprisoned air replacing the pigment.

In certain American butterflies, "angle wings," the first brood of the season, developing during the cool, moist weather of early spring, is darker than the succeeding generation exposed to the heat of July and August. But in butterflies with pigments chemically different from the melanin of the "angle-wings," e.g., *Araschnia levana-prorsa* of Europe, the summer brood (*prorsa*) is much the darker.

The changeable hues of the chameleon, depending on the contraction and expansion of pigment cells under control of the nervous system by way of the eyes, are comparable to the transitory color phases of many fishes, like the flounder, which becomes coarsely or finely mottled to correspond to the nature of its pebbly background.

Dr. Longley, observing tropical fishes in Florida and descending among them in a diver's suit, finds that the brilliant blue and blue-green fishes which live near the surface, seen from below and against the sky, are almost invisible. So are also the brilliant red and yellow ones which lurk among the gayly colored corals and seaweeds at the bottom.

The artist-naturalist Abbott H. Thayer discovered that the concealing coloration of birds and mammals is greatly enhanced by their light-colored lower surfaces, which neutralize the shadow cast upon the ground and help render the creatures invisible. Moreover, great masses of brilliant colors are much less conspicuous if broken into irregular patches or stripes, as in many wild mammals of the jungle or grassy plains, the principle of camouflage, adopted by the navies during the World War.

A test of the utility of concealing coloration is that the animal instinctively makes use of it. The blue indigo-bird shouts out its song in safety from the topmost branches of the tree where it is effectively concealed against the blue sky. The lively chicks of the ruffed grouse stand stock-still amid the brush at the approach of danger. The Grapta butterfly, with bark-like wing coloration exposed when its wings are closed over its back, alights and rests with apparent confidence upon the trunk of the tree. J. H. G.

COLOR BLINDNESS, a disturbance of the color sense, manifested by the inability to differentiate be-

tween certain definite colors. The condition is usually congenital, but may be acquired, particularly in certain diseases of the optic nerve. The congenital form is much more wide-spread than is commonly known, approximately 3% of all males being affected to a more or less extent and about 2/10 of 1% of females. The rarest form is that in which all colors appear as an indefinite gray and any recognition of color is by association and not by actual visual perception. Next in order of frequency comes the trichomat who sees only three colors—red, green and violet. The intermediary hues are recognized as color, but cannot be named accurately. The most common type is the dichomat who perceives only yellow and blue and their adjacent spectral hues. Red is seen as a shade of yellow, but sufficiently clearly so that by association it is recognized as red. Violet falls into the blue class and most frequently cannot be differentiated. Green elicits no color sensation at all. Owing to the wide-spread nature of color blindness, color tests form an important phase of eye examinations for industrial positions, such as railway engineers, marine pilots.

H. S. G.

COLOR GUARD, a military unit, comprising two sergeants and two privates which bears the organization and national colors. The senior sergeant carries the national colors and commands the guard, the other sergeant carries the organization colors.

COLORIMETER, an instrument for measuring the color of light. The light to be measured and a standard light are observed simultaneously, and the intensity of the standard is varied until a match is obtained. This standard light is obtained in a variety of ways, and thus gives rise to many types of colorimeters. In the Nutting monochromatic colorimeter, light of the same hue as that of the given light is obtained by dispersing white light through a PRISM and picking out the appropriate spectral hue. Then, a varying amount of white light from another source is added to this hue until the proper saturation is obtained. The intensity is varied by rotation of Nicol prisms, by alteration of slit widths or by rotation of sectors. The trichromatic colorimeter employs three beams of light which have passed through red, green and blue FILTERS, respectively, and which are then superposed on a screen. Any shade can be matched by varying the intensity of each beam. Colorimeters in which liquids form the standards are also in use, the measurements being made in terms of the depth of liquid of a certain concentration. See also CHROMATOMETER.

COLORING SUBSTANCES. See DYES, NATURAL; DYES, SYNTHETIC.

COLOR LIGHTING. See ILLUMINATION, ARTIFICIAL; COLOR.

COLOR PHOTOGRAPHY. The Lippman process of color photography employs a photographic plate carrying a special fine-grained emulsion which is placed in the camera (see CAMERA, PHOTOGRAPHIC) with the glass surface turned toward the LENS and with mercury in contact with the emulsion. The

LIGHT which forms the image passes through the glass and emulsion, is reflected by the mercury and passes back through the emulsion. As a result of this double passage through the emulsion, standing light waves are produced which create an image composed of thin parallel layers of silver spaced according to the WAVE-LENGTH of the incident light. These layers of silver, when viewed by reflected light (*see REFLECTION*), produce, by interference, the original colors of the object. The technical difficulties encountered and the slow action of the emulsion have prevented the method from having any practical applications.

In a typical three-color process, three fundamental colors are selected which, by combination in varying proportions, will yield all the colors required in the image. Three FILTERS are provided, each of which transmits one of these colors, and an exposure is made through each filter. Positive transparencies are made, and these are optically superposed so that each is viewed through a filter similar to that through which the original exposure was made. The composite image will appear in the colors of the original object. This is termed a three-color, additive process because, in general, each part of the reproduction is formed by the addition of three portions of light, each of which has been transmitted through a separate filter.

There are various ways in which the optical superposition may be obtained. For projection purposes, each of the images may be projected by a separate stereopticon through its appropriate filter, and the images superposed on a single screen. In the Lumière process, the three images are on a single plate. In making the plate there is first applied a single layer of starch grains which are transparent and which have been dyed red, yellow and blue. The sensitive emulsion is placed over the layer of starch grains, and the exposure is made through the glass side of the plate. In finishing, the developed image is reversed so that the portions affected by the light are transparent. The plate then, in reality, carries three pictures made up of the portions of the surface behind the red, yellow and blue grains of starch respectively. The plate is viewed by transmitted light and the images are fused because the grains of starch are too small to be resolved by the eye. The Paget process is the same in principle as the Lumière process, except that the screen is a geometrical arrangement of the three colors and is produced by a printing process.

The kodacolor MOTION PICTURE process is a three-color additive process in which the aperture of the camera lens is divided into three parts, each of which is covered with one of the filters. The exposure is made through the celluloid surface of the film which is embossed to form a large number of tiny lenses. As a result, the image is composed of a corresponding number of subordinate images of the lens aperture. The image is reversed and the portion of each subordinate image which is transparent depends upon the color of the incident light and the portion of the

aperture which contained the filter by which it was transmitted. The projection lens has a composite filter similar to that of the camera lens, and the small lenses on the film now serve to direct the light from any portion of the film through the portion of the lens aperture covered by the appropriate filter, so that the final image is in natural colors. The subordinate images, which together compose the picture, are not resolved by the eye.

With a two-color process, two fundamental colors are used instead of three, and two filters are employed. The two-color process necessarily reproduces the colors with less fidelity than the three-color. In an additive process a composite color is produced by the addition of portions of light, each of which has passed through a different filter. In a subtractive process, each portion of the reproduction is produced by light which has passed through all the filters employed. The final image is formed by superposed filters which vary in depth of color for different portions of the image, and the colors of the filters are selected so that the light not necessary for the desired color rendition is absorbed, i.e., subtracted from the incident light. With the subtractive process, white corresponds to a transparent portion of the film, whereas, with the additive process, white is built up from three portions, each of which has suffered a loss of light by absorption (*see ABSORPTION OF LIGHT*) in passing through the filter. It follows that the subtractive process is favorable for brilliant projection. The technicolor process for colored motion-picture projection is a subtractive process. *See also PHOTOGRAPHY. I. C. G.*

COLOR PRINTING, the processes of relief, intaglio, and photographic printing used to produce color effects. Colored inks must be used for each shade desired unless it is possible to combine two or more colors, as in process work. One color plate must be impressed upon the paper at a time. This may be done in rapid succession by the wet process on a multicolor press, or by the dry process, in which the colors are printed singly and the ink allowed to dry before the paper goes through the press again. Each of these processes has peculiar disadvantages. In the wet process, for instance, the successive plates lift some of the wet ink left on the paper by previous impressions. This is met by the use of extremely volatile oils as carrier for ink pigments, by rapid artificial drying, and by using for successive color impressions ink with less stickiness. In addition to the expense and delay of several handlings, the dry process must cope with the expansion and contraction of the paper. Delicate register work can be secured only under constant conditions of atmospheric humidity. Precautions must be observed in the use of certain color pigments. For example, pigments used for the production of certain red values possess a chemical affinity for copper, so that, if the printing plate is a copper electrolyte or halftone, the reactions almost instantly alter the color tones. Nickel, chromium or some other neutral surface must be used for such colors.

Color is used in printing for two purposes: for the

psychological value, and to imitate nature. The first color printing served the former purpose, while the invention of LITHOGRAPHY brought crude attempts at natural color picturization, evidenced by the ornate labels of a generation ago. Three and Four Color Process methods have solved the problem satisfactorily. Process color work is done by all the PRINTING methods: relief or letter-press, lithography and gravure. A few expert operators have applied the principle with marked success to the photo-gelatin process. See also WATER COLOR PRINTING. E. W. P.

COLORS, MILITARY AND NAVAL, the national and regimental flags, one of each, carried by an unmounted regiment or comparable military or naval unit. In the army the two flags carried by mounted or motorized regiments or comparable military units are known as standards. The regimental color or standard corresponds in color to the facings of the branch and bears in the center the regimental coat of arms or badge. The national color or standard, the Stars and Stripes, is carried on the right of the regimental color or standard.

The U.S. Navy colors consist of the national flag. In port, colors are hoisted aft at 8:00 A.M. and are kept flying until sunset, when they are hauled down. Under way, they are hoisted at the gaff until clear of port or when falling in with another vessel. The colors are half-masted as a symbol of mourning, and when hauled down in action indicate surrender or submission. Dipping the colors is a compliment of salute, but U.S. warships are forbidden to dip their colors except in return for a similar compliment. The boats of a man-of-war are required to keep their colors flying while absent from the ship. Regulation ceremonies are performed at hoisting and hauling down colors, the bugle, the ship's band and a guard being used. In battle, colors are flown at each mast-head. See also FLAG.

COLOR TEMPERATURE. See HEAT TREATMENT.

COLOSSEUM, the great amphitheater of ancient Rome, the ruins of which still stand. It was built in the 1st century A.D., and was the chief center of entertainment and amusement of the imperial city. The Colosseum was built in an elliptical form; its greatest length was 616 feet and its greatest depth 510 feet. Although its seating capacity was only 50,000, it could be made to accommodate some 87,000 spectators. It was surrounded by a 160-foot wall, and its four stories varied in architecture. The first of these was Tuscan-Doric, the second Ionic, and the third Corinthian in style. The seats rose in four tiers, and special booths were provided for the privileged classes. The arena was the center of activity. In it were staged the great gladiatorial combats for which the city was famous.

COLOSSIANS, EPISTLE TO THE, in the New Testament, is commonly accepted as a letter from the Apostle Paul to a church at Colossae, a town of Phrygia on the Lycus which was destroyed by an earthquake in the seventh year of Nero's reign. It

is sometimes called "the twin epistle to the Ephesians" (see EPHESIANS, EPISTLE TO THE), because many expressions in the one are made use of in the other. This feature, however, has led some scholars to call it "a genuine letter of Paul's interpolated later by the author of the Ephesians." The letter was occasioned by a visit of Epaphras, the founder of the Colossae church, to Paul in Rome, where he discussed with the Apostle certain doctrines being entertained by his church, which may have been a kind of early Gnosticism. Paul endorses the teaching of Epaphras, and portrays Christ as the real image of God and the Lord of all creation.

COLT, SAMUEL (1814-62), American inventor, was born in Hartford, Conn., July 19, 1814. He rebelled at attending school and went to sea in 1830, during which year he made a model of a repeating firearm with a revolving barrel. In 1833 he made both a pistol and rifle on this principle and, after patenting them in Europe and America, began their manufacture. He failed to introduce his invention into the army until the Mexican War but after that his business prospered and in 1854-55 he built at Hartford a great armory which he directed until his death, Jan. 10, 1862.

COLTON, a city in San Bernardino Co. in southern California, situated 58 mi. east of Los Angeles; served by bus lines and three railroads. The city is a shipping point for the crops of a rich farming region which produces fruit, vegetables and poultry. Colton also ships great quantities of cement, lime and marble. It has large packing-houses, flour mills, cement plants and factories turning out concrete products. Spanish missionaries arrived in 1774. Colton was founded in 1783 and incorporated in 1887. It is the seat of a junior college. Angeles National Forest is a short distance eastward. Pop. 1920, 4,282; 1930, 8,014.

COLTSFOOT (*Tussilago Farfara*), a perennial herb of the composite family called also coughwort. It is native to banks and roadsides in northern Europe and Asia and extensively naturalized in the northeastern states and adjacent Canada. The creeping rootstock gives rise to slender flower-stalks, about a foot high, bearing at their summits large, solitary flower-heads which appear in early spring before the large, orbicular, slightly lobed and toothed leaves, green above and white-woolly beneath. The leaves and rootstocks, formerly in high repute as a remedy for coughs, are still sometimes used medicinally.

COLUM, PADRAIC (1881-), Irish poet, was born at Longford, Ireland, Dec. 8, 1881. He was educated in local schools, and his first literary venture was his association with WILLIAM BUTLER YEATS and Lady Gregory in the IRISH THEATER movement. He then helped to found *The Irish Review*, acting as its editor in 1912-13. Among his writings are *Wild Earth*, a collection of poems; and the plays, *The Land*, *The Fiddler's House*, *Thomas Muskerry* and *My Irish Year*.

COLUMBA, ST. (521-97), "the Apostle of Caledonia," was born at Gartan, Donegal, Ireland, on Dec.

7, 521. He was educated at the monastery school at Moville, and at St. Ninian's Magnum Monasterium on the shores of Galloway. Changing his name from Colum to Columba, he set out in 563 for Scotland with 12 companions and landed at Iona, the holy island of the Druids in the Hebrides, on May 12, beginning from this point the conversion of the northern Picts. His journeys led him to all the inhabited isles and the glens of the mainland. The monastery of Iona, now in ruins, was founded by him in 565 and he became its first abbot. He died at Iona, Scotland, on June 9, 597.

COLUMBA (gen. *Columbae*), the dove, a small constellation of fairly bright stars just south of Canis Major. See *STAR: map*.

COLUMBAN, ST. (c. 543-615), Irish missionary to Italy, was born in Leinster, Ireland, about 543. Educated at the monastery of Bangor on the coast of Down, at 40 years of age he became a monk and felt called to preach in foreign lands. He eventually set sail with 12 companions, and about the year 585 was received by the King of Burgundy. In France he founded the monastery of Luxeuil in the Vosges, and labored there for 20 years. In 612 he went to Milan, whose king and queen gave him a tract of land at Bobbio where, near the river Trebbia, he founded another monastery. He died in a cave of the Apennines, near Bobbio, Italy, on Nov. 21, 615.

COLUMBIA, a city in northern central Missouri, the county seat of Boone Co., situated 125 mi. west of St. Louis. Two railroads serve the city. There are coal mines and quarries in the vicinity and livestock, grain and forage are raised. The city has flour mills and a few small factories; it is also a publishing center. In 1929 factory output reached about \$2,000,000; the retail trade amounted to \$10,409,085. Located here are the University of Missouri, Stephens College, Christian College for Women and the Missouri Bible College. Columbia was founded in 1821 and incorporated as a city in 1826. Pop. 1920, 10,392; 1930, 14,967.

COLUMBIA, a borough in Lancaster Co., southeastern Pennsylvania, on the Susquehanna River, 10 mi. west of Lancaster. It is served by two railroads. The borough is a trade and manufacturing center, producing iron, steel, machinery, silk and lace. The industrial output, 1929, was valued at \$12,503,905. The retail business in 1929 amounted to \$3,266,509. The Quakers founded Columbia in 1726; it was incorporated in 1814. Originally it was called Wright's Ferry. At one time Congress considered making it the capital of the United States. The original bridge crossing the Susquehanna was burned in June, 1863, in order to stay the advance of the Confederate Army on Philadelphia. Pop. 1920, 10,836; 1930, 11,349.

COLUMBIA, the capital of South Carolina, a city and the county seat of Richland Co. It is situated in the center of the state on the Congaree River, and served by airplanes, bus lines and four railroads. Abundant hydroelectric power is generated from the

Saluda River 10 mi. away. The leading industries are textile and fertilizer manufacture, printing and foundry work. In 1929 the factory output was valued approximately at \$18,000,000; the retail trade amounted to \$27,990,405. The city is set in a fertile region; the chief crops are cotton, corn and legumes. Columbia is the seat of the University of South Carolina, founded in 1801. During the Civil War its buildings were used as a hospital. There are several smaller colleges, one for Negroes and three theological schools, one of which is also for Negroes. The site was selected as the state capital in 1786; the city was chartered in 1854. During the Civil War Columbia was burned by Sherman's army. It was once the home of Woodrow Wilson. Pop. 1920, 37,524; 1930, 51,581.

COLUMBIA, a city in southwestern Tennessee, the county seat of Maury Co., situated near Duck River, 46 mi. southwest of Nashville. Airplanes and two railroads serve the city. The surrounding country produces grain, tobacco and potatoes. Oil and phosphate are found in the vicinity. Columbia is noted as a mule market. The chief manufactures are flour, lumber products and overalls. JAMES K. POLK began his law practice here. Nearby are a number of interesting caves. Columbia was founded in 1800 and incorporated in 1822. The city was a scene of activity during the Civil War. Pop. 1920, 5,526; 1930, 7,882.

COLUMBIAN SPIRITS. See *METHANOL*.

COLUMBIA (S.C.), OCCUPATION OF, Feb. 16, 1865, in the CIVIL WAR, an incident of the march of the Federal army under Gen. Sherman through the Carolinas. Having entered Savannah (see *SAVANNAH, BATTLE OF*) on Dec. 25, 1864, Sherman rested until Feb. 1, when with 60,000 troops he set northward to join Gen. Grant. With Gen. Howard commanding the right wing and Gen. Slocum the left, as in *SHERMAN'S MARCH TO THE SEA*, the army traversed the boggy lowlands of South Carolina, devastating the country with particular vindictiveness because of the Union soldier's hatred for the state which had been first to secede. Gen. Wade Hampton, occupying Columbia, withdrew his force without offering battle. Shortly after the Federal troops entered, the city was razed by fire, perhaps from cotton-bales ignited by Confederates to prevent the bales from being confiscated by the enemy, perhaps by Federal soldiers under orders, but most probably started accidentally in the mêlée of soldiers, Negroes and escaped prisoners.

COLUMBIA RIVER, a large river of western United States, flowing to the Pacific Ocean. Its source is in Columbia Lake in the Rocky Mountain trench in British Columbia, whence it flows northward to the 52nd parallel, turns sharply around to the south and flows through a series of narrow lakes before it reaches the international boundary near the northeastern corner of Washington. Its course in Canada measures 465 mi. In Washington the stream cuts a winding channel southward through the lava fields of the Columbia plateau and at the Oregon line turns westward to form the boundary between the two states until it reaches the Pacific. Its total length is 1,150 mi. and

its drainage basin 259,000 sq. mi. of which 38,700 are in British Columbia. The fall from source to mouth is approximately 8,000 ft. Of its tributaries, the most important are the Kettle and Kootenai rivers in Canada and the Snake, Deschutes and Willamette in the United States. The volume at its mouth varies from 50,000 to 1,160,000 second ft.

The system as a whole provides water to irrigate vast semi-arid regions, and has immeasurable potentialities for water power, the development of which has scarcely begun. Along its lower course the river flows through the Cascade Mountains in the Columbia Gorge where such waterfalls as Latourell, Bridal Veil, Horsetail and Multnomah are spectacular features. Navigation is possible for 400 mi. from its mouth with the aid of canals built around the obstructing rapids, and large cargoes of lumber, minerals and food products are distributed by this waterway. It provides the only good harbor on the Pacific coast between Cape Flattery and San Francisco.

The Columbia was named by Capt. Gray of Boston who discovered its mouth in 1792, and its lower course was explored by Lewis and Clark in 1804-05. It is famous for its salmon fisheries.

COLUMBIA RIVER HIGHWAY, a notable scenic highway of the western United States entirely within the state of Oregon. It begins at Pendleton and follows the southern bank of the great Columbia River westward through the Cascade Mountains to the sea, terminating at Astoria. Its course was laid out so as to present views of the natural wonders of the river canyon. In some places it runs along the lower banks of the river where the chief attractions are waterfalls such as Bridal Veil, Latourell, Horsetail and Multnomah. Other stretches follow the rocky ledges of the canyon high above the river where snow capped mountain peaks are visible. When the road passes through Portland, Mt. Hood and Mt. St. Helens may be seen.

This highway is everywhere 24 ft. wide and covers a distance of 336 mi., of which 202 mi. are paved and 134 oiled rock or gravel. Five mi. west of Hood River it passes through a mountain spur by a tunnel similar to that of Axenstrasse on Lake Lucerne, Switzerland. Windows are cut in the face of the tunnel lighting the interior and providing a view of the river below.

COLUMBIA UNIVERSITY, a coeducational, non-sectarian institution and the largest university in the United States, is situated chiefly on Morningside Heights, New York City. It had its origin in the establishment of King's College, which was chartered by George II in 1754 and began its first building on the lower end of Manhattan two years later. The college was suspended during the Revolution. Reopened in 1784 as Columbia College, it was governed as a state university for three years by the Regents of the State of New York; but in 1787 it again became an independent institution. In 1857 it was reorganized, and in the same year moved to a new site between 49th and 50th streets on Madison Ave. Nine

years later the college became Columbia University, and in 1897 moved to the present site.

Columbia University now includes Columbia College, College of Physicians and Surgeons, the schools of Law, Engineering, Architecture, Journalism, Business, Dental and Oral Surgery, Library Service, and the Graduate School of International Affairs; the faculties of Political Science, Philosophy, and Pure Science.

Component parts of the university are BARNARD COLLEGE, for women; TEACHERS COLLEGE; College of Pharmacy; St. Stephen's College, at Annandale-on-Hudson; and the Seth Low Junior College, Brooklyn. The College of Physicians and Surgeons since 1928 has formed the nucleus of the Medical Center, on West 168th St. Columbia helps to maintain a School of Tropical Medicine in Porto Rico. Connected with it are also the institutes of Cancer Research, Educational Research and Public Health. The Columbia University Press, established in 1903, issues departmental studies, scholarly volumes and several periodicals.

The number of students enrolled in all the schools in 1930-31, including the summer session and extension courses, was 37,808. The teaching staff of 3,014 members were headed by Dr. NICHOLAS MURRAY BUTLER. In 1931 the university's resources were estimated at \$140,138,152. The library contains 1,305,596 volumes.

COLUMBINE, the common name for a large genus (*Aquilegia*) of plants of the crowfoot family. There are about 50 species, native to north temperate regions, some 20 of which occur in North America. Many of these, together with numerous varieties and hybrids developed in cultivation, are grown as ornamentals. They are attractive perennials, with slender stems, much divided leaves, and showy drooping or sometimes erect flowers of unusual form, the five petals being extended into long, hollow, nectar-bearing spurs. The common garden columbine (*A. vulgaris*), with numerous double forms and color varieties, is a native of the Old World. The native American species best known in cultivation include the red columbine (*A. canadensis*), of the eastern States and Canada; the yellow columbine (*A. chrysantha*), of the Southwest; the scarlet columbine (*A. formosa*), of the Pacific Northwest, and the blue columbine (*A. cœrulea*), the state flower of Colorado, of the Rocky Mountains.

COLUMBIUM, a metallic chemical element, sometimes called niobium, belonging to the same group as vanadium and tantalum. It occurs chiefly in the minerals columbite and samarskite, and was first discovered by Hatchett in 1801, though for some time afterwards it was thought to be identical with tantalum. In the metallic form it is steel gray, as hard as iron but lighter, is malleable, and melts at 1950°C. It is generally given the symbol Cb, though sometimes, especially in Europe, the symbol Nb, for niobium, is used. Its atomic weight is 93.3; it has not yet been put to any commercial use.

COLUMBUS, CHRISTOPHER (c. 1451-1506), Spanish navigator, was born probably at Genoa, Italy, about 1451. He was a weaver by trade, but in 1476 sailed to England, later returning to Lisbon, Portugal. Here he married Felipa Moniz de Perestrello, daughter of a navigator who had established a colony on Porto Santo, an island in the Madeira group. Columbus visited Porto Santo in 1479, and spent much time examining the logs and charts of Perestrello. It was doubtless about this time that he thought of the possibility of reaching India by a western route, which he hoped would prove shorter than the eastern one the Portuguese were seeking by way of Africa. In 1481 he began searching for a financial backer, and after ten years he succeeded in interesting Ferdinand and Isabella of Spain, who gave him three ships, viz., *Santa Maria*, *Pinta*, and *Nina*. On Aug. 3, 1492, he sailed from Palos. After sailing for several weeks without sighting land and noticing the variations in the compass, his men became frightened and threatened to mutiny. Shortly after there were signs of land and on Oct. 12, 1492, he landed on an island which he named San Salvador, which is now thought to be one of the Bahama Islands. He next visited Cuba and Haiti and then returned to Spain, arriving at Palos on March 15, 1493 where honors were showered upon him.

The possibility of further wealth in the West appealed to the Spaniards. Columbus had little difficulty in equipping a fleet of 17 vessels and sailed on a second voyage Sept. 25, 1493. Land was sighted Nov. 3, which was named Dominica Island. He later discovered Porto Rico, Jamaica and other islands in the Caribbean Sea, finally leaving for Spain, arriving at Cadiz June 11, 1496. He was favorably received and was promised ships for a third voyage.

After many delays six vessels were assembled and sailed May 30, 1498. This time he cruised along the northern shore of South America, discovered Trinidad, and returned to his colony at Santo Domingo. There he found the colonists discontented and he was drawn into controversies which finally resulted in the King of Spain sending Francisco de Bobadilla to replace Columbus, who was ordered back to Spain.

The fourth and last voyage undertaken by Columbus, was this time with four vessels, the object being to find a shorter route to India than that discovered by Vasco da Gama. Columbus sailed from Spain in May, 1502, arrived at Santo Domingo in June, then after refitting, sailed West, and explored the coast of Central America. Worn out by hardships and sickness, he returned to Spain in 1504. He died at Valladolid, May 20, 1506.

BIBLIOGRAPHY.—W. Irving, *Life and Letters of Christopher Columbus*; W. E. Curtis, *Authentic Letters of Columbus*; S. W. Bassett, *Story of Columbus*; C. R. Markham, *Life of Christopher Columbus*.

COLUMBUS, DIEGO (1476-1526), son of Christopher Columbus, born probably at Lisbon, Portugal. He married into the powerful Alba family in 1508, and through the influence of his wife was made

admiral of the Indies and governor of Hispaniola in the same year. The hereditary office of viceroy of the Indies, which Isabella and Ferdinand had conferred on his father, he received in 1511, after prolonged litigation. He was recalled to Spain in 1515 and 1523, and died there in 1526.

COLUMBUS, a city in western Georgia, the county seat of Muscogee Co., situated 95 mi. southwest of Macon, on the Chattahoochee River. Bus lines and three railroads serve the city. There is an airport. Cotton and dairy products are raised in the vicinity. Textiles are the chief manufactures, the city having also machine shops, cotton seed oil refineries and fertilizer factories. In 1929 the manufactures reached an approximate total of \$39,000,000; the retail trade amounted to \$22,567,666. During the Civil War the last battle fought east of the Mississippi River took place at Columbus. Augusta Evans Wilson, the author of *St. Elmo*, lived in this city. Columbus was founded in 1828 and incorporated in 1829. Ft. Benning, a unique Infantry School, is located nine mi. south of the city. Pop. 1920, 31,125; 1930, 43,131.

COLUMBUS, a city in southeastern Indiana, the county seat of Bartholomew Co., situated on the White River, 42 mi. southeast of Indianapolis. Bus and truck lines and two railroads serve the city. There is an airport. The chief crops of this region are corn and wheat. Furniture, leather and iron products are manufactured. Columbus was founded in 1821 and incorporated in the same year. Pop. 1920, 8,990; 1930, 9,935.

COLUMBUS, a city of northeastern Mississippi, the county seat of Lowndes Co. It is situated near the Alabama state line, on the Tombigbee River and Federal Highway 45 and is served by four railroads. Columbus is a shipping center for the lumber, cotton, corn, hay and cattle produced in the region. Columbus has recently developed a large dairying industry and also has a large floral industry. In 1929 its manufactures were valued approximately at \$2,000,000; the retail trade amounted to \$6,229,470. It is the seat of Mississippi State College for Women. The city was incorporated in 1821. Pop. 1920, 10,501; 1930, 10,743.

COLUMBUS, a city in eastern Nebraska, the county seat of Platte Co., situated at the confluence of the Platte and Loup rivers, 87 mi. west of Omaha. The city is connected with two railroads, and has two airports. The chief crops of the vicinity are corn, wheat and alfalfa; cattle, hogs and poultry are also important interests. The city has flour mills, poultry and produce packing houses, wooden sole shoe factories and sand-gravel, cement block and brick plants. Columbus was founded in 1856; incorporated in 1865. Pop. 1920, 5,410; 1930, 6,898.

COLUMBUS, the capital of Ohio, and the county seat of Franklin Co., situated near the center of the state. It is a port of entry at the junction of the Scioto and Olentangy rivers, about 100 mi. northeast of Cincinnati. Five trunk railroads and several branch lines afford transportation, as well as traction lines, buses, motor truck lines and the large Port Columbus

airport. Proximity to coal, iron and natural gas fields, and its position in the path of transcontinental travel make Columbus important as a commercial and industrial center. According to the Census of 1930 its 451 wholesale and jobbing concerns distributed \$202,095,466 worth of merchandise in 1929. It also had a large trade in live stock, grain, wool, iron and coal. Its manufactures, which had a total value of approximately \$212,000,000, included iron, steel, paper, printing, glass, shoes, packed meats and food products. The city's 3,745 retail stores, which did a total annual business of \$169,966,296, gave full-time employment to 16,363 men and women; the wholesale trade proper amounted to \$113,990,784. Columbus is the seat of Ohio State University and Capital University, a Lutheran institution founded in 1850. The state penitentiary and the state institutions for the insane, the feeble-minded, the blind and the deaf are here. Originally settled in 1797, the town became the county seat in 1824 and was incorporated as a city in 1834. Pop. 1920, 237,031; 1930, 290,564.

COLUMELLA, LUCIUS JUNIUS MODERATUS (1st century A.D.), Latin writer, was born at Gades, Spain, in the 1st century A.D. He lived part of his life in Syria and part in Rome. His chief work was a dactylic hexameter poem on agriculture called *De Re Rustica*, in 12 volumes. His *De Arboribus* was a less pretentious work on a similar subject. He was a contemporary of SENECA. Columella is believed to have died at Tarentum.

COLUMN, a vertical support, especially, in structural engineering, a vertical support of steel; and in architecture, a support whose horizontal section is circular. Columns have been important factors in architecture wherever intermediate supports between walls have been necessary. The circular column had two independent origins, one, the wood post whose simplest form was a tree trunk with the bark stripped off; the other, from the gradual lightening of square stone piers by cutting off the corners, giving an octagonal plan, cutting off those corners, and so establishing a sixteen-edged pier, and so on. If such a polygonal pier has its sides hollowed, in order to sharpen the effect of the edges, the result is, in essence, a fluted column such as are found in the 12th dynasty rock-cut tombs of Beni Hassan, and in the temple of Hatshepsut at Deir el Bahri. This form in Egyptian art is known as the "proto-doric." Other types of Egyptian column probably were derived originally from tree trunk posts; and in the architecture of the Aegean, the use of tree trunk columns, sometimes with stone capitals and bases, was highly developed, the Aegean wood columns always being set with their small ends down. Even the decorative engaged stone columns that flanked the door of the Treasury of Atreus in Mycenae, about 1200 B.C., had the same peculiarity. In Aegean life, columns were not only used structurally, but occasionally as cult objects of undoubted phallic origin; and there are traces of the same influence in some of the stone Egyptian column forms.

The Hellenic Greeks, using masonry columns generally, though the famous temple of Hera at Olympia had wooden columns at first, reversed and curved the taper, putting the small end at the top, and elaborating and refining the outline and treatment of the shaft, the capital, and the base, using, however, only a few general systems which crystallized into the **ORDERS**—Doric, owing much to Aegean influence; Ionic, based on Asiatic bracket capital origins; and Corinthian, a later form enriched with foliage. To these forms Roman inventiveness added a fourth, the Roman Corinthian. It was undoubtedly the fact that few general families of form were used which allowed the great refinement and perfection of each.

Although some Romanesque and most Byzantine columns were distantly based on Roman classic precedent, having even that curved taper called **ENTASIS**, the greater number of medieval columns represented a new approach to column design. Classic columns had been usually either monoliths, or built up of horizontal drums the full width of the column, with occasional use of brick or rubble in the smaller and less important work. In western medieval work, the larger columns, such as those enormous circular piers found in some Anglo-Norman churches, were built of small stones; while the smaller columns remained monolithic. The entasis, or taper, was generally absent. It is characteristic of Gothic architecture that an adequate knowledge of the strength of stone often allowed columns of much smaller relative diameter than that of classic columns. Particularly in the 13th century work, both of France and England, minor columns were often so thin as to appear fragile.

Another Gothic column development was that of the clustered column, in which large columns were combined with small colonnettes set close to them or partly imbedded in them, which expressed the support of vaulting ribs, or important arch moldings above. In England this development was carried further than in France, and often used for purely decorative effect; the small colonnettes were often of black marble while the core was of light stone, as in Salisbury Cathedral, 13th century. The Renaissance gave a new importance to the column, and particularly in its later phases used columns lavishly for decorative as well as structural purposes. This tendency was carried even further during the classic revival periods of the 19th century, and the use of many columns reached occasionally the point of being a disease.

In modern work in Europe and America there has been in the 20th century a great reaction against this abuse of the column. Except in smaller work, the structural masonry column seldom appears, and the decorative use of column forms is distinctly unpopular. Mohammedan column forms are generally developed from classic or Byzantine origins, save in their capitals. (*See CAPITAL*.) Hindu columns are highly developed; an infinite variety in their design exists, and they are usually richly decorated with moldings, bandings and carvings. In China and Japan the traditional type of timber building has given great im-

portance to columns. These are usually tall, slender, typically wooden in appearance, without developed capitals, and often decorated with rich red or black lacquer. Occasional stone columns are to be found in China like those of the Temple of Confucius at Chufu, Ming Dynasty, which are carved with magnificent dragons. No special type of stone column was developed, however, the general forms following the wooden prototypes. See **BASE**; **CAPITAL**; **ORDER**.

T. F. H.

COLUMN, in military science, a military formation in which the elements are placed one behind the other, the principal dimension being depth or distance from front to rear as opposed to line formation in which the principal dimension is width from flank to flank. Column formations facilitate control. The column of fours or squads is the usual formation of mounted or foot troops when marching on a road.

In naval science, single column formation is when each ship follows in the wake of the leading ship; double column is when there are two parallel single columns at a prescribed distance from each other. The column is in natural order when the van is leading, in inverse order when the rear squadron or division is leading.

COLUMN OF JULY, THE, a pillar of bronze in the Place de la Bastille, Paris, completed in 1840. It commemorates the French citizens who fell in the Revolution of July, 1830. The column is divided into five parts on which appear the names of the 615 who died in the conflict and are buried in the vaults beneath. On the summit is a bronze figure of Liberty.

COLUMN VENDÔME, a column erected in the center of the Place Vendôme, Paris, by Napoleon I to commemorate his victories in the campaign of Austerlitz. It was designed by Denon, Gondouin and Lepère after the Trajan column at Rome and constructed of masonry encrusted with plates of bronze made by melting down 1,200 Austrian and German cannon. Formed into a spiral 300 yds. long, the metal is divided into plates representing the campaign of 1805. The column, 142 ft. high, is crowned by a statue of the emperor in imperial robes. In 1814 the statue was torn down by the Royalists, in 1831 replaced by a new statue of Napoleon in greatcoat and tricorn and in 1863 a replica of the original figure took its place, only to be thrown down by the Communards in 1871. In 1875 the fragments were pieced together into the present statue.

COLURE, the name given to the two meridians, or hour circles, drawn through the celestial poles and the equinoxes or solstices, respectively.

COLVILLE, a once numerous Salishan-speaking tribe which occupied the territory between Kettle Falls and the Spokane River in eastern Washington. The few survivors are gathered on the Colville Reservation in Washington.

COLVIN, SIR SIDNEY (1845-1927), English critic, was born at Norwood, London, June 18, 1845. He was graduated from Trinity College, Cambridge,

in 1867, and was Slade Professor of Fine Arts at Cambridge from 1873-85. He was keeper of prints and drawings at the British Museum from 1884-1912; in 1921 he was knighted. Colvin's friendship with ROBERT LOUIS STEVENSON, beginning in 1873, is immortalized in the *Vailima Letters*. Through his work on the Edinburgh Edition of Stevenson and the *Letters of Robert Louis Stevenson* he became recognized as the leading Stevenson authority. He also wrote a *Life of Walter Savage Landor*, 1881, and a notable *Life of John Keats*, 1887. Colvin died in London, May 11, 1927.

COMA, a condition of unconsciousness or insensibility, which may be due to a large number of causes. It is usual to divide the most important causes into five groups: (1) alcohol, (2) epilepsy, (3) injury and diseases of the head, (4) opium and other narcotics, (5) uremia, acidosis and cholemia.

In unconsciousness due to imbibing too much alcohol the coma is rarely complete. The breathing is deep, the pupils of the eyes are dilated, and the temperature is below normal. The odor of alcohol on the breath is convincing.

The unconsciousness following an epileptic seizure is short in duration, usually lasting from a few minutes to an hour.

Hemorrhage or bleeding into the brain is the most common cause for coma grouped under injury and diseases of the head. The onset of the unconsciousness is sudden. The coma is deep and in many instances one side of the body is paralyzed. The pupils are dilated and may be unequal in size. The temperature is normal.

Concussion of the brain is also a cause of unconsciousness. In such cases the pupils are usually unequal in size. Other diagnostic signs are usually not present.

Other causes for coma are meningitis, which is inflammation of the membranous covering of the brain; encephalitis, or inflammation of the brain tissue; brain tumor, and abscess of the brain.

UREMIA is a condition of poisoning resulting from chronic kidney disease. In uremia the substances normally excreted by the kidneys are found in increased amounts in the blood. The onset of unconsciousness is gradual. The pupils are contracted. The breathing which is alternately rapid and then slow and barely noticeable, is known as Cheyne-Stokes breathing.

In diabetes acidosis may occur. This acidosis is due to the fact that the fats are not completely burned in the body, so that acetone and diacetic acid are formed. In coma due to acidosis the onset is gradual, the breathing is short and rapid, and there is a sweet odor to the breath.

The accumulation of the bile in the blood is known as cholemia and causes unconsciousness. Cholemia occurs in diseases of the liver, such as acute yellow atrophy of the liver.

In coma due to opium or morphine poisoning, the unconsciousness comes on gradually, the pupils are

contracted and pin-point in size, the breathing is slow, the skin is moist and the temperature normal. Other drugs which cause coma are chloroform, ether, chloral, bromides, veronal and also carbon monoxide.

Among the other causes of unconsciousness are severe malaria and other severe fevers, loss of a large amount of blood from bleeding internally or externally, heat stroke and lead poisoning.

The determination of the cause of coma may be difficult. The method of investigation includes the obtaining of the patient's previous history of such diseases as nephritis, diabetes and epilepsy. A description of the onset of the coma may also be obtained. The examination of the patient in coma also gives much information concerning the cause. The depth and rate of breathing must be noted. The head is examined for injury and paralysis is searched for. The size and equality of the pupils are important things to be considered. An odor of alcohol or acetone on the breath aids greatly in the diagnosis. W. I. F.

COMA, in optics, the hazy fringe seen around an image in an optical system, especially in a Microscope, due to imperfections in the LENSES. It arises chiefly from CHROMATIC ABERRATION, SPHERICAL ABERRATION and departure from true spherical lens surfaces.

COMA BERENICES (gen. *Comae Berenices*), the hair of Berenice, a constellation north of Virgo formed by numerous faint stars clustering close together, producing a hazy effect. It contains large numbers of spiral nebulae and occupies that area of the sky where lies the north pole of the Milky Way. See STAR: *map*.

COMANCHE, a plains tribe, the only group speaking a Shoshonean dialect. Their dialect is closely related to that of the Shoshoni of Wyoming and was the trade language for the southern Plains. By pressure from the Sioux they were forced southward from their original habitat in southern Wyoming until, early in the 19th century, they ranged around the headwaters of the Arkansas, Red, Trinity, and Brazos rivers in Colorado, Kansas, Oklahoma and Texas. They were continually at war with the Spaniards and extended their depredations into Mexico; later this enmity was transferred to the Texans against whom they also waged continuous war. In the latter half of the 19th century they were attached to the Kiowa Agency in Oklahoma with their ancient allies, the Kiowa, where in 1931 about 1400 lived by farming or on the revenues from oil lands. Formerly they were nomadic buffalo-hunters, living in skin-covered tipis. Early in the history of white contact they acquired horses and became the finest horsemen of the Plains. Many of the material traits of their culture are like those of the Kiowa, though in others they are more typical Plains Indians.

COMANCHEAN PERIOD, called also the Lower Cretaceous, the third subdivision of the MESOZOIC ERA of geological history. The rocks then formed are well developed in southwestern United States, the habitat of the Comanche Indians, whence the name.

COMANS, a Turkish people established in the Russian steppes from 1061 to 1210. In the 13th cen-

tury a part of them settled in Hungary, where they have been magyarized and given the name of Kun. Their other appellations, Polovtsy in Russian, Valwen in Germany and Falones in Latin, are explained as "pale faces." A text-book of their language, containing, *inter alia*, a number of hymns of the Roman Catholic Church, though one seems to be an original composition, was written in Latin by a Christian monk about 1300. This precious manuscript (*Codex Comanicus*), once Petrarch's property, now belongs to the Library of St. Mark in Venice. It has been edited by Count Geza Kuun, himself a descendant of the Comans, at Budapest in 1880, and has been studied by several Orientalists. V. M.

COMBACONUM, a city in the Tanjore district of Madras, British India, better known as KUMBakonam.

COMBAT PLANE. See AIR FORCE.

COMBINATION LAWS, LABOR, laws forbidding or regulating the combination of labor for purposes of COLLECTIVE BARGAINING. Usually employed to designate early and obsolete acts in England and the United States aimed at preventing trade unionism. See also TRADE ORGANIZATIONS.

COMBINATIONS AND MERGERS. Late in the 19th century, the rapid growth of industries in the United States, with resultant increase in competition, led to the formation of large combinations of capital for the purpose of taking over independent industrial companies and thus eliminating ruinous competition. One of the first devices in the war on competition was the pool. Such pools were associations of manufacturers who agreed to place the marketing of their joint products under a central body with the object of regulating output and thus stabilizing prices. However, pools were hard to control, their provisions were not enforceable under the common law and good faith could be preserved only by the imposition of fines and penalties. When the pools failed they were followed by the formation of trusts intended to have legal status, permanent existence and rigid control. The capital stocks of the companies were assigned to a board of trustees who issued trust certificates in lieu of shares so assigned. The assignment of stock vested control of the corporations in the trustees, who became responsible for the management of the companies. Such power enabled them to limit output, maintain prices and otherwise effect stability and impose authority. The legality of the trusts was finally attacked and in 1890 the SHERMAN Act, prohibiting combinations in restraint of trade, was passed and trusts were driven out of business so far as their ability to effect combinations was concerned.

About this time the state of New Jersey passed an epochal revised General Corporations Act in which a corporation was granted the right to acquire and hold stocks of another corporation. Under this act, corporate organizations could be promoted solely in order that financial corporations might control, indirectly, operating companies through ownership of their stock. Holding companies thus originated grew

in number and flourished until at present gigantic industrial combinations have come to control most of the major industries. The chief objects of such combinations is to eliminate ruinous and demoralizing competition by obtaining such a grip on the industries that prices may be stabilized. Price control in responsible hands does not always mean exorbitant prices, but serves rather to control values in such a manner that price-cutting shall not become general in times of depression. Modern business seeks to concentrate production in large plants located with due regard to sources of raw materials and also to the market. Combinations in some cases control the sources of raw materials and are better able to deal with labor. Expense of distribution and management and office and sales cost are lowered by combination.

Opposed to these advantages is the public dread of monopoly and fear of extortionate prices, although there is an upper limit to prices beyond which demand ceases. There is also the danger of speculative management in which earnings as a basis of capitalization may be overstated and the acquirement of properties by a syndicate which sells to its members, as directors of a holding corporation, such properties at a price beyond actual value. Proposals have been made tending toward Federal regulation of combinations.

A merger is the combination of two or more corporations into one business which retains the name of one of the merged units. In a merger there is outright ownership of the combined units, whereas in the case of a holding company control of the combined properties is attained through ownership of part or a controlling portion of the stock.

COMBINATORIAL ANALYSIS, that branch of algebra which treats of combinations and permutations. It is a subject whose roots go back to antiquity, while its later developments find application in almost every branch of mathematics. Permutations and combinations, distributions, probability, symmetric functions, determinants, higher plane curves, and partitions are only some of the headings under which the subject is studied.

Permutations and combinations very early attracted the attention of scholars and thinkers. Traces of this interest are found among the Chinese (arrangements of the mystic trigrams as in \equiv , date uncertain) and among the Greeks of the pre-Christian period. Chrysippus (c. 280-c. 207 B.C.) found the number of combinations of 10 axioms to be more than 1,000,000. In the 1st century of the Christian era we find the forerunners of the Cabala deeply interested in the study of permutations. To this they were led by their belief in the mystic properties of arrangements. Some four centuries later Boethius (c. 500 A.D.) stated the rule that the number of combinations of n elements is 2 at a time is $\frac{1}{2}n(n-1)$. In general, it may be said that the work done during the first millennium (A.D.) did not go beyond the discovery and application to a few cases of the basic principle of the theory, namely, the idea that if one operation may be performed in m

ways and another in n ways, the two operations may be performed in mn ways.

Pascal's Triangle. In the 12th century the Hindu mathematician Bhāskara enunciated rules for finding the number of permutations of n things r at a time. A little later we find, in one of the works of Chu Shi-Kiē (1303), coefficients of the development of $(a+b)^m$ which are identical with the numbers of combination of m elements taken n at a time arranged in the form of a triangle,—a form now known as Pascal's triangle. A similar triangle was found by Heiberg in a Greek manuscript of Euclid's *Elements* dating back to the 12th century.

Distribution is a name applied to the separation of elements into various classes. This study is of comparatively recent origin and the processes involved are of a more advanced nature. Some of the results are remarkable, in that they join together subjects which are usually considered to be far apart. For example, the number of ways in which r groups can be formed out of n different objects is $n!$ times the coefficient of x^n in the expansion of $(e^x - 1)^r$. According to this, the number of ways in which 11 different gifts may be given to 8 boys, no boy being left without a gift, is $11!$ times the coefficient of x^8 in the expansion of $(e^x - 1)^8$, that is, 479,001,600.

That the number of distributions should have anything to do with the base of the system of logarithms is surprising enough, but recalling that the same expansion also yields the STIRLING NUMBERS of the second kind, we cannot help wondering at the essential unity of the various branches of our science which thus comes to light. Another example is seen in the fact that the total number of ways in which n objects can be distributed into 1, 2, 3 . . . , n in different parcels is $n!$ times the coefficient of x^n in the expansion of $e^{e^x} : e$.

Kirkman's School-Girl Problem is interesting because it is one of the many problems that arose out of purely geometrical considerations concerning the nature of double tangents to curves of the fourth degree, thus linking the subject with the theory of higher plane curves. Kirkman skillfully disguised his problem to make it rather innocent looking and simple, as follows: 15 school girls are supposed to be in the habit of taking daily walks together. They usually arrange themselves in five rows, three each. How should they arrange themselves so that in the course of one week each girl should have a chance to be in the same row with every other girl? The difficulties involved become apparent only when one attempts to solve it or to read the several pages devoted to the solution in a work like Netto's *Lehrbuch der Combinatorik*.

Probability. The relation between our subject and the theory of probabilities is apparent since the latter is to a large extent concerned with the enumeration of combinations subject to certain conditions. It has been said that almost every theorem in combinatorial analysis has its application to the theory of probability. In fact the first chapters in almost every work

on probability deal with permutations and combinations. See COMBINATIONS; PERMUTATIONS; PROBABILITY AND ERROR. J. G.

COMBINES. See COMBINATIONS AND MERGERS.

COMBINES, machines which cut and thresh grain in one operation. They are equipped with a sickle, reel and conveyor for feeding the cut grain directly to the threshing machine. These machines are made in sizes which cut a swath from approximately 8 to 30 ft. in width, but the 10, 12 and 16 ft. sizes are the most common. Power for operating the machine is usually supplied by an engine on the combine, but some of the small machines are operated by a power take-off from a tractor. When equipped with an engine the combine may be pulled either by horses or a tractor.

The windrow harvester and pick-up attachments were developed to overcome difficulties due to unequal ripening and green weeds. With this auxiliary equipment the crop may be windrowed, picked up when dry and threshed with the combine. Combines can now be found in practically all states where grain is grown extensively. From 1920 to 1930, inclusive, over 84,000 combines were sold in the United States. Wheat, barley, rye, oats, rice, soybeans, cowpeas, clover and alfalfa have been harvested and threshed with this machine. See also BINDERS; THRESHERS.

W. M. H.

COMBING, the textile manufacturing process for separating long and short fibers and for continuing the paralleling of the long fibers begun in CARDING. In the combing machine based on the so-called rectilinear principle, used extensively in cotton (see COTTON and COTTON MANUFACTURE), and in French-worsted manufacture, the fibers are held in the form of a fringe, while successive rows of wire teeth on a revolving cylinder pass through them, straightening them and pulling out the short fibers. After this another row of teeth penetrates the long fibers while they are seized at the front edge of the fringe and pulled forward to join the long fibers previously combed, this action serving to comb the edge of the fringe formerly attached to the uncombed fibers. In the Noble type of comb, used extensively in the Bradford-worsted system, the fibers are pressed into the vertical pins on the circumferences of two horizontal circles at the point of tangency, only the long fibers extending from one circle to the other. Revolving of the circles serves to separate the two sets of pins, the long fibers being thereby pulled away from the short. Combing imparts smoothness and strength to the ultimate yarn. Cotton is combed only when a slender, high-quality yarn is desired; woolen, never; worsted, always; flax, sometimes.

E. D. F.

COMBUSTION, a term designating the general process of burning which implies the chemical interaction of fuels with oxygen (usually oxygen from the air) and the consequent evolution of heat. To secure combustion, intimate contact between the combustible material and oxygen (air) is required. When the fuel is available in gas form, such contact is easily ob-

tained, due to the ease with which the air mixes with the fuel, as illustrated by the ordinary domestic gas burner.

In the case of liquid fuels, gasification usually precedes combustion and may be accomplished in various ways. In a kerosene lamp the heat of the flame volatilizes the liquid drawn to the top of the wick by capillary forces, and the vapor thus formed supplies the fuel which maintains the flame. The less volatile fuel used in an oil burner is vaporized by spraying a stream of finely divided (atomized) liquid into the combustion zone. When a solid fuel, such as coal, is burned on a grate, the contact with air is less intimate and combustion can proceed only on the exposed surface of individual lumps. Under normal conditions, the initial combustion is incomplete and yields carbon monoxide, which in turn burns with a flame at the top of the fuel bed, where additional air is usually supplied. Volatile constituents in the fuel are usually gasified in the lower combustion zone and burn similarly in the zone above the solid fuel. To obtain the advantage of intimate mixing with air possible with gaseous and liquid fuel, there has lately been a tendency in industry to employ coal in powdered form, the finely divided coal dust being injected into the combustion zone in much the same manner as liquid is introduced in an oil burning furnace.

To initiate combustion it is necessary to raise the temperature until the so-called ignition point of the particular fuel in question is reached. Once combustion has been initiated, the heat liberated by the process itself is usually sufficient to maintain the temperature well above the ignition point, and combustion, therefore, becomes self-sustaining.

Under certain circumstances, combustion may be initiated without the application of external heat. Thus, when coal is stored in large quantities without proper ventilation, spontaneous combustion may occur, due to localized slow oxidation which eventually raises the temperature to the ignition point. In the case of gases and vapors, it is sometimes possible for combustion to take place at a temperature well below the normal ignition point in the presence of a catalytic surface (see CATALYSIS). The ability of certain materials to sustain combustion on their surface at high temperature is utilized in the design of certain industrial furnaces.

When a gaseous fuel is mixed intimately with oxygen or air in certain proportions, combustion will, on ignition, take place with explosive violence. To give this effect, the percentage of the fuel present has to lie between certain limits, called the explosive limits, of that particular gas. Explosive mixtures may also be obtained with finely divided liquid or solid combustibles. The INTERNAL COMBUSTION ENGINE utilizes the explosion of mixtures of vaporized or finely divided liquid fuel with air as the source of its automotive power. Solid fuels have so far not been used for this purpose, but the ability of combustible solids to burn with explosive violence when suspended in

air in a finely divided state is well illustrated by the destructive force of dust explosions. P. K. F.

BIBLIOGRAPHY.—R. T. Haslam and R. P. Russell, *Fuels and their Combustion*.

COMBUSTION, HEAT OF, the amount of heat produced when unit mass of a substance is completely consumed by oxidation. Heats of combustion are usually stated as so many small CALORIES per gram or so many BRITISH THERMAL UNITS per pound. Heat of combustion in calories per gram is converted into B.t.u.'s per lb. by multiplying by 9/5. Thus, the heat of combustion of charcoal is 8,000 calories per gram, or 14,400 B.t.u.'s per lb. For organic compounds, heats of combustion are sometimes stated in kilogram-calories per gram-molecular-weight. The heats of combustion of gaseous fuels are usually stated in B.t.u.'s per cu. ft. See also COMBUSTION.

COMBUSTION CONTROL, the regulation of furnace operation to secure the proper combustion of fuel and, in the case of BOILERS, to produce the desired quantity and pressure of steam. The instruments used to this end include draft gauges, PRESSURE GAUGES, CO₂ recorders, PYROMETERS, STEAM FLOW METERS, manometers, and water-level gauges.

Draft Gauges are used to measure the difference between the pressure of the gases within a furnace, boiler setting or chimney, and of the air outside. The simplest type comprises a graduated glass tube, either vertical or inclined, filled with a light fluid. One end of the tube is open to atmospheric pressure and the other is connected to the chimney or other point where the draft is to be measured. The difference in the atmospheric and chimney gas pressures is indicated in inches of water by the position of the fluid with respect to the scale.

In the pointer-type of draft gauge, the draft is given by the position of a bell floating in oil, the space inside the bell above the liquid being connected to the chimney. The movement of the bell is transmitted to the pointer through an arrangement of levers.

Water-Level Gauges in their simplest form comprise a heavy, vertical glass tube so connected to the boiler that the water stands in it at the same level that it is in the boiler. These water columns may be used in connection with a float arrangement which operates a warning signal when the water is either dangerously high or low. However, on most of the larger modern boiler installation, the supply of feed-water is automatically controlled by float or thermostatic regulators that control the speed of the feed-water pump or the amount of opening of a valve in the supply pipe.

CO₂ Recorders remove samples of flue gas and measure the amount of CO₂ contained in each, indicating the result by a pointer and recording it on a clock-driven chart. These instruments operate on various principles, among which are the variation in density of the gases as compared with air, the variation of the position of a float in the gases after the CO₂ has been removed by caustic potash, and the

variation in the refractive index of the gases according to the CO₂ percentage. See also COMBUSTION ENGINEERING.

COMBUSTION ENGINEERING, the applied science of bringing fuels and atmospheric air together so as to produce COMBUSTION and of utilizing the heat produced thereby in the most economical manner. In order to accomplish this, it is necessary to have a knowledge of the characteristics of various fuels and of their availability in different localities, of the suitability of various types of combustion equipment, such as hand-fired grates, mechanical STOKERS, PULVERIZED-FUEL apparatus, and gas and OIL BURNERS and of the proper type of FURNACE with regard to the FUEL and the manner in which the heat is to be utilized. This knowledge must extend to the properties of the numerous materials required in furnace construction, to the characteristics of the various auxiliary equipment, such as coal PULVERIZERS, hand-fuel pumps and FANS and BLOWERS, as well as to the scientific principles involved in the chemistry and physics of combustion, the flow of fluids and heat exchange. See HEAT EXCHANGE EQUIPMENT. The combustion engineer is also more or less directly interested in the conversion of heat into mechanical power, depending somewhat upon whether he is directly concerned with INTERNAL COMBUSTION ENGINES or with furnaces for the generation of steam. W. L. DEB.; K. T.

COMÉDIE HUMAINE, LA ("The Human Comedy"), the unfinished series of nearly a hundred novels by HONORÉ DE BALZAC; published 1829-50. Perhaps the most colossal plan ever conceived by any novelist, the *Comédie Humaine* was designed to present a panoramic picture of the entire life of France in the author's day, not only of the life of all classes in Paris, but of the life of every provincial class as well. An effect of unity is achieved by using certain of the characters repeatedly. Among the best novels of this famous series are *Cousin Pons*, *Cousine Bette*, *Père Goriot*, *Eugénie Grandet*, *The Chouans*, and *César Birotteau*.

COMEDY, a dramatic composition in prose or verse written to excite amusement either by means of its situations or characters, or by the representation of the foibles of humanity or the satiric portrayal of contemporary manners. While it is possible for a comedy to be more or less serious in theme, its happy ending and amusing characters and lines clearly differentiate it from TRAGEDY. On the other hand, its refinement of tone and delicacy of treatment define its demarcation from FARCE and burlesque. The origin of comedy may be said to be based on the natural human tendency of any two persons to be amused by the eccentricities of a third and it is thus, at least in germ, as old as humanity itself.

Street parades in the towns of ancient Greece in which the processes of fertility were lewdly represented by the revelers led naturally to dramatic attempts of the same character, and out of this, says Aristotle, developed Greek comedy. ARISTOPHANES was the first great name in Greek comedy, and his

plays abound in the rough buffoonery of the street revels. The early Greek word for comedy means revel, which was the usual ending of early comedies.

With its development into a highly skilled branch of the dramatist's art, comedy has frequently taken on the national coloring of the country in which it originates, so that in many cases a type of wit or humor that appeals to one race is almost incomprehensible to another. That this is by no means always true is proved by the fact that Aristophanes amuses modern audiences just as he did those of ancient Greece. The Greeks were extremely fond of comedies which ridiculed the foibles of well-known contemporaries, and so generously did the Greek comic dramatists provide entertainment of this description that the law finally intervened to prevent the public mockery of prominent citizens. This law was circumvented by the actors wearing masks made in unmistakable resemblance of the person ridiculed. But to this day the satirical portrayal of the various aspects of human frailty remains one of the chief staples of high comedy.



GREEK COMIC MASK
From a bas-relief

Comedy is broadly divided into two classes: the comedy of character and that of situation. In the former, chance plays little or no part, the characters being responsible for their own fate. In other words, they are not accessories to the plot, but are the plot itself. The comedy of situation or plot, on the other hand, depends for its interest on the ingenuity with which a surprising or intricate situation, or series of such situations, is brought to a conclusion, the audience deriving pleasure from the fact that the outcome is unknown. Although the characters in such a play may be little more than puppets, a high degree of dramatic craftsmanship is necessary for a successful play of this type. Of recent times a new type of comedy has arisen that defies classification as tragedy, and is yet too vigorous, too dramatic, and too much concerned with the most profound realities of life to be classed as traditional comedy. Such plays are called by the French *dramas bourgeois* and are considered by them as comedies notwithstanding the seriousness of theme and the poignancy of treatment. Perhaps the nearest equivalent in English to this type of comedy is the TRAGI-COMEDY or the PROBLEM PLAY.

English and French comedy offer some wide differences. French comedy, of which MOLIÈRE is the outstanding creator, is an act of the reason, appealing solely to the mind; the laughter resulting is critical rather than understanding. English comedy, exemplified most brilliantly in Shakespeare, appeals both to the mind and to the heart; the spectator's common humanity with his characters is easily felt, and the resulting laughter is sympathetic, springing from the heart. The noted exception to this definition is the comedy of manners of CONGREVE.

BIBLIOGRAPHY.—G. Meredith, *Essay on Comedy*, 1877; G. B. Shaw, *Dramatic Opinions and Essays*, 1907; Lane Cooper,

Aristotelian Theory of Comedy, 1922; A. H. Thorndike, *English Comedy*, 1929.

COMEDY OF ERRORS, THE, a boisterous comedy of mistaken identity, by SHAKESPEARE. An early work acted in Dec., 1594, it is based chiefly on the *Menaechmi* by PLAUTUS, and is a comedy of two brothers, Antipholus of Ephesus and Antipholus of Syracuse, and their completely similar servants, the twin Dromios. The brothers and their twin servants are picked up at sea separately, following a shipwreck, neither brother aware that the other has survived. Later innumerable complications arise when the Syracusan Antipholus is mistaken for his Ephesian brother, and vice versa, the brothers Dromio adding to the worst of the entanglements. Everything is righted at last when the brothers are brought face to face in a trial before the duke.

COMENIUS, JOHN AMOS (1592-1670), educational reformer, was born at Nivnitz, Moravia, in 1592. He was a leader in the Moravian Church; but it is for his educational reforms that Comenius is best known. The first of these reforms was the result of finding impractical the methods of teaching Latin when he was a student at Prerau. A few years later he prepared new Latin textbooks which greatly simplified the study of the language. While a student at the University of Herborn, 1612, he came under the influence of Alsted, the encyclopedist, which may have suggested his ambitious attempt to organize all human knowledge in a universal encyclopedia. From 1612-14 he studied at Amsterdam and Heidelberg and was then made rector of the gymnasium at Prerau. In 1618 he became pastor at Fulnek but three years later was driven out by invading Spanish soldiers. In 1627 he and other Moravians were so persecuted that they fled to Lissa, Poland, where he was made director of the gymnasium. Here he wrote his *Magna Didactica* (Great Didactic) in which he outlined his educational theories. These included compulsory education, the obligation of the State to provide education and kindergarten training. In 1648 he was elected Bishop of the Moravian Brethren. His *Orbis Pictus* (World in Pictures), 1657, was the first successful attempt to use illustrated textbooks. Comenius died at Amsterdam Nov. 15, 1670.

See W. S. Monroe, *Commenius—and the Beginnings of Educational Reform*, 1900; J. W. Adamson, *Pioneers of Modern Education*, 1905.

COMET, a heavenly object, somewhat hazy in appearance, which when bright or very near the earth usually shows a "tail." From this fact it derives its name which means *the hairy one* in Greek. Comets are members of the solar system and move in very elongated ellipses around the sun, taking anywhere from 3 or 4 years to several hundred thousand years to complete their circuit. About one in five of the comets that are discovered becomes visible to the unaided eye, the remainder being discernible only through a telescope. Only a dozen or so each century become really conspicuous. At rare intervals one may be seen in broad daylight. Depending upon their orbits,

comets may be observable for a few days only or for more than a year. If observed for but a short time it is usually impossible to tell what the period of revolution is. In this case only a short arc of the orbit in the neighborhood of the sun can be calculated and no prediction made as to its next return.

Up to the present some 900 appearances of comets are known. Of those seen in recent years about 70% were first appearances, while 30% were returns of comets observed before, and whose orbit around the sun had been calculated. It is estimated that as many as 1,000 comets visit the neighborhood of the sun each century. The masses of comets are exceedingly small, probably even considerably less than one millionth of that of the earth.

Their volumes, however, are enormous. The head, or *coma*, usually ranges from 10,000 to 150,000 miles in diameter, although some comets are known to have been more than a million miles in diameter. When a tail is visible to the unaided eye, it is rarely less than 5,000,000 miles long, and may sometimes approach 100,000,000. Modern investigations on the nature of cometary tails lead to the conclusion that these are formed by a stream of particles driven out of the comet under the action of the rays of light from the sun, and that, once seen, they really form no longer part of the comet, but are irretrievably lost to it. From the large volume and the small mass of comets it follows that comets are extremely tenuous of composition; it has well been said that a comet may consist of particles as large as marbles, distributed a dozen or so over every cubic mile. Among the best known comets is Halley's comet, taking 76 years to complete its course around the sun, which stretches from inside the orbit of the earth to beyond that of Neptune.

COMIC STRIP. In the United States comic strips started in 1892 in the San Francisco (Cal.) *Examiner* with *Little Bears and Tigers*, drawn by James ("Jimmy") Swinnerton. The Hearst newspapers developed the idea of strips elsewhere in the country, putting them into the Sunday supplements in colors. *The Yellow Kid*, created by R. F. Outcault (1863-1928), was one of the first strips in color. The Chicago (Ill.) *Daily News* was one of the first newspapers to syndicate comic strips. In 1910 H. C. ("Bud") Fisher (1884-) created *Mr Mutt* for the San Francisco *Chronicle*. This character began, without his diminutive pal, *Jeff*, as a luckless race-track follower.

Comic strips are now an established feature of American and some foreign newspapers. Generally speaking, the characters, whose vicissitudes and adventures are followed daily by a considerable part of the American public, satirize contemporary life and manners in varying degrees of subtlety. The leading figures in the majority of successful strips are men or children. A popular combination is a physically large but mentally deficient character who is a foil for a small but wily partner. Conversation is colloquial and is a prolific source of modern American slang

as well as one of its chief means of propagation.

Jiggs of *Bringing Up Father*, by George McManus (1884-), *Mutt and Jeff*, by Fisher, *The Gumps*, by Sidney Smith (1877-) and *Skippy*, by Percy Crosby (1891-) are by-words in American life. Many strips have been made into motion- and talking-pictures. *Krazy Kat*, created by George Herriman, is one of several animated cartoons.

Comic strips have developed from an occasional daily strip to a daily page of strips with an eight-page section in colors on Sunday. American comic strips are translated into nine languages and approximately fifty strips are syndicated in the United States. See also CARTOON.

COMITIA, an assembly of citizens officially appointed to act on certain specified matters. The original assembly of the Roman people was the *comitia curiata*, arranged by curiae (see CURIA), which had jurisdiction over serious crimes, treason, appeals from the consuls; conferred the *lex curiata de imperio* (see IMPERIUM), and performed certain religious duties. In 339 B.C. it lost its real power to the *comitia centuriata*, which had been formed by Servius Tullius, and was presided over by the consuls or other officers with imperium for the election of such officers, for legislative purposes, and most of the former functions of the old *comitia curiata*. The *comitia tributa*, first originated in the Republic, was the assembly of the people primarily for the election of their officers (without imperium), legislation, and deliberation of public questions. Its laws (*plebiscita*) were binding on all citizens after 287 B.C. L. K. B.

COMMA, in the measurement of musical vibrations, the name for minute sound-intervals theoretically existing between two adjoining notes and emanating from one of them in the process of tuning.

COMMANDANT, a title given to the officer in military command of a garrison, post, military school, naval district or a navy yard in the United States. The title is given also to the governors of United States island possessions, Guam and Samoa, where there are naval stations; as to the commanding officer at the air station at Pensacola, Fla., and Guantanamo, Cuba. The executive officer at the Naval Academy, Annapolis, Md., has the official title Commandant of Midshipmen.

Majors and colonels often serve as commandants in the Army, with higher ranking officers for the most important commands. These officers are responsible for the proper and efficient functioning of their commands and are accountable for the property supplies and equipment at their station.

Where there is a navy yard, a naval operating base, or a naval station at the same location as the District Commandant, his title is Commandant of the Naval District and Navy Yard; Commandant of Naval District and Naval Operating Base; Commandant Naval District and Training Station. In some cases, there is also a navy yard and naval operating base under the district command. The senior officer of the MARINE CORPS is the Major General Commandant. R. E. C.

COMMANDEERING, the forcible taking or seizure of men or goods for war or military purposes. The military commander, while in occupation of a country or area, may commandeer men and goods for necessary functions and services. A country may commandeer the services of its citizens in time of war and private property and resources for the purpose of prosecuting a war. The property of neutrals (*see* NEUTRALITY) in time of war may be commandeered, such as neutral ships under the right of **ANGARY**.

COMMANDER-IN-CHIEF, an officer in supreme command of the armies or navies, usually the entire land or naval forces of a state, nation or allied nations. The President of the United States and the rulers of most states bear the title. A commanding officer is one in command of a division of the forces under the commander-in-chief.

COMMENSALISM, a term applied by Van Beneden (1876) to an association between two species of animals that "eat at the same table." As a rule one member of the association is larger and stronger than the other and tolerates or helps the weaker species without being injured or benefited itself. The stronger species is often called the host and the weaker species the commensal. For the most part commensals live outside of their hosts and are sometimes spoken of as guests or messmates. Commensals usually obtain food, shelter or transportation as a result of this type of association. For example, certain barnacles attach themselves to the skin of whales and are carried about into various regions where food conditions are more favorable than would probably be the case if these sessile animals were to remain in one place. The remora fish is perhaps the best known commensal among vertebrate animals. Its anterior dorsal fin is modified to form a sucker by means of which it attaches itself to sharks, turtles, whales, other large aquatic animals and floating objects such as boats. It is able to swim, but prefers to be carried about by other animals. Its food consists of other fish and probably of the scraps obtained when the shark, or other animal to which the individual is attached, has a meal.

Many commensals live in the homes of their hosts. Among the most interesting of these are those that live in the structures built by the insects known as white ants or termites. These commensals are called termitophiles and include principally other insects such as beetles, aphids, ants and others. Commensals that live in close association with true ants are known as myremecophiles. Some of these are favored by the ants because they produce agreeable excretions; others resemble their ant hosts in shape and color so closely that they are said to mimic them.

Another type of commensalism is illustrated by animals that live within the bodies of other species of animals. Thus fishes and prawns are known to live within the bodies of sea cucumbers; shrimps live in sponges and coelenterates; and crabs within the shells of oysters. Many Protozoa that live in the digestive tract or blood stream of man and other vertebrates

are considered by many to be commensals. For example, the commonest amoeba that lives in the human large intestine and is present in about 50% of the general population is often called a food robber since it does no injury to its host but simply feeds on food material ingested by man.

It seems probable that other types of association have developed from commensalism. For example, symbiosis, a condition in which neither partner is injurious but each is beneficial to the other; and parasitism, in which the commensal has become injurious to its host.

R. H.

COMMERCE, fundamentally the acquisition of commodities upon relatively favorable terms. To this the only significant exception is the case of persons traveling for their own pleasure. The alternative to commerce is complete individual self-sufficiency. Differences in native ability or in natural resources, and the economies to be obtained by localization and specialization of industry, usually make it cheaper for two or more persons to supply their needs by division of labor, transportation, and trade, than it is for each individual to manufacture all which he may require. The advantages of such a procedure are generally recognized to-day within the boundaries of national political units, although smaller political bodies sometimes dispute them even within a single nation. There is, however, something to be said upon the other side. Many responsible statesmen argue that nations, at least, should seek a reasonable degree of self-sufficiency, even at considerable sacrifice, for any one of three reasons. The first rests upon the military necessity of producing in each country the munitions and material needed in time of war. The second is the "infant industries argument," looking to the eventual perfection of lines of endeavor in which a nation may, temporarily, be weak. And the third reason is based upon the belief that some kinds of activity, such as manufactures, develop intelligence and character more than other kinds, such as agriculture and mining, and so, should be encouraged quite apart from questions of productivity or cost. While opinions differ with respect to the validity of these contentions, most civilized countries in the world to-day administer protective tariffs, intended to restrict commercial intercourse or to change its character by hampering the trade in some articles as compared with the trade in other articles. Likewise the transit of persons is affected by immigration laws (*see* IMMIGRATION), the requirement of passports and visas, and burdensome taxation; while countries discriminate against instruments of transportation and communication owned by foreigners in so far as they are able to do so without provoking retaliation.

The foreign commerce of the United States during the year ending December 31, 1929, amounted to \$9,640,356,000. Of this \$4,399,361,000 consisted of imports, and \$5,240,995,000 of exports. Northwestern and central Europe and Canada took between them 55% of what was sent out, but the imports came from more widely distributed sources, including heavy

contributions from Japan, China, British Malays, and British India. The United States imports substantially all of its tin, rubber, coffee, silk, and nitrates, besides large quantities of sugar, vegetable oils, and wool. The articles imported are either not found in the country, or can be produced there only with relative difficulty. On the other hand, it exports wheat, fruits, tobacco, cotton, petroleum, steel, copper, and a great variety of machinery, automobiles, and packing-house products, in the preparation of which it is efficient.

The average rate of duty levied in 1929 upon imported articles was 13.48%; the former figure being controlled by a very considerable free list.

During post-war years the heightened sense of nationalism produced by conflict caused a general raising of tariff barriers in western Europe as well as in the United States, and it is very probable that the interruptions to commerce which resulted sharpened antagonisms and, in general, retarded the return to normal business conditions. S. D.

BIBLIOGRAPHY.—*Annual Yearbook and Statistical Abstract*, published by U. S. Dept. of Commerce; F. W. Taussig, *Tariff History of the United States*.

COMMERCE, DEPARTMENT OF, a governmental department that looks after the promotion of the commercial, mining, manufacturing, shipping, fishing and transportation interests of the United States. The Secretary of Commerce, a member of the Cabinet, heads the Department and is aided by an Assistant Secretary, an Assistant Secretary for Aeronautics and numerous bureau chiefs. One important phase of the work of the Department is the promotion and regulation of civil aeronautics, under the Air Commerce Act of 1926, by the establishment of civil airways, landing fields and beacon lights; the examination and licensing of aircraft and airmen; weather service on airways, and the encouragement of municipal ventures in airports. The Radio Division has the duty of inspecting radio equipment on all vessels clearing from American ports, and of working in conjunction with the Federal Radio Commission in enforcing the Radio Act. Under the Department of Commerce also are the Bureau of Census, Bureau of Foreign and Domestic Commerce, Bureau of Standards, Bureau of Fisheries, Bureau of Lighthouses, United States Coast and Geodetic Survey, Bureau of Navigation, Steamboat Inspection Service, Patent Office and Bureau of Mines. S. C. W.

BIBLIOGRAPHY.—*Report of the Department of Commerce; Congressional Directory*, 1931.

COMMERCIAL ART, a practical application of esthetics, notably design and color, to modern industry. It is the result of a growing consciousness in the 20th century that beauty and proportion are inherent in the Machine Age and that good taste, efficiency and profit can be combined. In the 19th century the western world underwent the initial processes of being transformed by machines. Amazed and delighted with new discoveries which added materially to every-day comforts and to enjoyment of

life, men and women were chiefly concerned with their usefulness. Primitive man was first satisfied that his pottery jar held water but with growing proficiency in its manufacture he was able to turn his thought and energies to proportion and decoration, and the jar became a work of art. Similarly, civilized man has begun to turn his attention to beautifying the products of the Machine Age.

The activities which come under the term commercial art include the various phases of ADVERTISING ART, as well as window display, package wrapping and the designing and styling of merchandise. Beauty is now an important selling-point. It has attained an economic status. Advertising art was the first great field of commercial art. This came as a result of the increased output of machinery and the consequent need for a quick turn-over. Advertisers demanded an improvement in the illustrations of their products, for reasons of sales psychology. Next came shops with artistic interiors and innovations in counter arrangements and window-displays. Factories with "landscaped" grounds and an increasing number of buildings for all purposes whose exteriors are architectural triumphs are properly included in the field of commercial art.

Artistic designing and so-called styling of merchandise is the result of keen competition for business. Two articles may be equally good but the one which presents the most attractive appearance will catch the attention of a purchaser. Fashions and vanity goods were the first to show the effect of artistic styling. Its sales advantages are now fully appreciated and styling is applied to foods, automobiles, railroad trains, building-materials, house furnishings, interior decorations, social stationery, book-bindings and to practically the whole realm of present-day luxuries and necessities.

The old-time hand-worker who superintended every step in the manufacture of his product has been superseded by the machinist who has nothing to do with the design or quality of the article and whose sole concern is the operation of his machine. Consequently, artists must attend to the designing of products before they get to the machines. Large companies have art laboratories and advisory committees which hold conferences on the artistic, scientific and utilitarian merits of their output. Automobiles are an outstanding example of the transforming touch of commercial art. Both high- and low-priced cars sold originally because they were automobiles. Later, however, the less expensive models attained a mechanical perfection which forced the high-priced cars to look for selling points other than size and power. Stream lines and beauty of design were adopted; eventually these were also incorporated in the low-priced cars which now compete with each other in good design. Similarly, the first phonographs were unsightly wooden boxes equipped with huge horns. When the novelty wore off a new selling feature was necessary; the horn disappeared and phonographs were housed in handsome cabinets. Radios did not go through

the same slow transition. As soon as they emerged from the experimental stage, well designed cabinets became a cardinal selling-point.

Simplicity and efficiency are the aims of commercial art. An article is stripped to the bare essentials which will permit accomplishment of its objective. These essentials are then designed according to art principles. In designing a bed, the commercial artist asks, "What is a bed?" The resultant product should be and generally is a comfortable mattress on a low metal framework with low, slightly curved head and foot-boards of wood or metal, and possibly an attached stand for a reading-lamp, books, and smoking accessories.

Since 1925 the development of commercial art has brought color into homes and made show-places of kitchens, clothes-closets and bathrooms. The housewife now has a minimum of 10 colors from which to choose the finish for her sink and kitchen garbage-can, and an equally wide range to select for bathroom appurtenances.

Merchandise must be enclosed in a wrapper which bespeaks its quality and which serves to arrest the attention of prospective purchasers. Present-day packaging is bright, gay and often "modernistic" in design. Cellophane has contributed to the development of this art. Hams come temptingly wrapped in transparent material, soaps in gay papers, and perfumes in handsome flacons. Staffs of artists are maintained by companies specializing in package wrapping. These companies submit samples and compete for a firm's business just as any other commercial house.

The United States was introduced to a new method of window display during the Christmas season of 1928 when Norman Bel Geddes created a sensation by arranging a window for a department store in New York which contained only three articles set against a modernistic background. The windows of leading stores and shops are arranged by trained artists in careful accordance with the principles of composition, balance and color value. The design of display fixtures is in itself a wide and growing field of artistic endeavor.

The commercial artist, it logically follows, is no longer regarded with condescension. Artists of distinction are increasingly aware that industry offers interesting opportunities. Commercial art has developed since 1920 to such a point that it has its own literature, periodicals and schools of specialized instruction.

BIBLIOGRAPHY.—G. C. Aymar, *Introduction to Advertising Illustration*, 1920; F. Kiesler, *Contemporary Art Applied to the Store and Its Display*, 1930; C. Knights and F. E. Norman, *Commercial Art Practice*, 1930.

COMMERCIAL EDUCATION may be defined as education and training which will prepare the student to enter commercial or business fields. It covers the wide range of education which at the lower level would be clerical training for the young boy or girl with only a grammar school education, and at the upper level training for business management which

is given in colleges and universities. The first form of commercial education was the apprenticeship method, in use in the United States until about the middle of the 19th century. One learned business methods by serving a period of apprenticeship to some one established in a commercial line in much the same way as lawyers and doctors in the early days received their training in their respective professions. As business developed, this method of instruction was recognized as being inadequate and schools were established to teach bookkeeping. Courses in typewriting and shorthand were added many years later. Private schools, frequently called business colleges, sprang up all over the country, and boys and girls flocked to them for their short courses.

By 1890 the attention of educators had been turned toward the demand for this specialized education, and in a few years they introduced commercial courses in the public high schools. While at first they were developed along the same lines as the courses in the private schools, they have been constantly improved and enlarged in scope, with the result that the private schools have been obliged to raise their standards of instruction. As the public high schools combined general education and special courses in commercial subjects, their graduates were naturally better equipped for entering business than the graduates of private commercial schools who for the most part had had only a grammar school education. To meet this competition, the private schools of better standing have been forced to seek out the high school rather than the elementary school graduates.

The phenomenal growth of commercial education started in 1915. In 1917 the Smith-Hughes Act authorized the Federal Board for Vocational Education to make a special study of commercial education throughout the country. The enrollment in commercial courses is increasing far more rapidly than the enrollment in all other courses, which is easily accounted for when it is realized that from 1910 to 1920 there had been an increase of over 2,000,000 employees in trade and clerical positions. An interesting phase of this growth is the increase in women employees, this being during the same period 97%. The increase of women in business has naturally been paralleled by a growing number of women enrolled in the commercial courses. At present two-thirds of these students are women.

With the increasing opportunities for men and women in the business world and the demand for greater efficiency, there has been a broadening of the scope of commercial education, with the result that many universities have established schools or departments of business (see BUSINESS ADMINISTRATION, SCHOOLS OF) and over 400 are offering courses to give their students a general knowledge of business, business organization and business management with the idea of training them to hold executive positions. By 1930 there were approximately 80,000 students majoring in business subjects in colleges and universities, and the total enrollment in commercial and business

courses in public and private schools, private business colleges and universities had exceeded 1,000,000 students. *See also* COMMERCIAL SCHOOLS. M. R.

See E. W. Barnhart, *Trends in Commercial Education*, 1928.

COMMERCIAL LAW, the body of law, including statutory law, applied to commercial transactions. This classification covers a great number of branches of jurisprudence and is perforce loosely used as a generic term. It is a phrase rarely found in judicial decisions except in those of the Federal courts. Usually, a Federal court will adhere to decisions of the state court, in order to attain uniformity of law within the same state. On questions of commercial law, however, Federal courts are not bound to follow precedent established by state courts when the law on such questions is unsettled. (*Union Bank v. Board of Commissioners*, 90 Fed. 7, 9.)

Among the many subdivisions of commercial law are admiralty, agency, bailments, banking, bankruptcy, bills of lading, brokers, carriers and warehousemen, contracts, corporations, commercial paper, factors, guaranty, insurance, mortgages, partnerships, sales, suretyship, trade marks, trade regulation, and unfair competition.

See also BANKRUPTCY; BILLS OF LADING; CORPORATION; LAW MERCHANT; MORTGAGE; NEGOTIABLE INSTRUMENT; PARTNERSHIP. C. F. W.

COMMERCIAL PAPER, the name given to those short term promissory notes which are offered through the open market to commercial banks and trust companies by commercial dealers or brokers. Their salability is based upon the financial strength of the borrowing concern, as the paper is not backed by any collateral security. Commercial paper, a business as practiced in the United States, is unique and has grown to considerable volume during the last 50 years.

The usual term of a commercial paper note is from four to six months, although conditions occasionally arise when the life of the note is somewhat shorter or longer. In no case, however, does the term exceed one year. The note is drawn for a stated amount and is payable on a definite date at a specified place. Interest is figured on the number of days the note has to run and is deducted from the face of the note when proceeds are returned to the borrower. The rate at which such interest is figured is governed wholly by market conditions and the financial standing of the borrower.

The paper is usually in the form of a promissory note of the maker drawn to his own order and endorsed in blank. In some cases the note of a corporation bears the added endorsement or guaranty of one or more of its principal owners. With the development of larger corporations, this added endorsement is not frequently found.

Commercial paper is used by a manufacturer or merchant requiring temporary funds to carry on current trading transactions which are generally completed, at least in theory, within the life of the notes, thereby making the notes self-liquidating.

It is the custom for the borrower on the open market to have a yearly audit made by a certified public accounting firm. This statement is supplemented by an elaborate system of commercial credit information, involving interim information, operating details, and bank and trade references which indicate the general standing of the borrowing concern in the trade, and the ability, acumen and honesty of those individuals responsible for the operations of the business.

On the question of the commercial credit of these concerns and the fundamental principles on which these credits are based, it is expected that the borrower has as a rule 100% of margin in cash, receivables and merchandise in excess of his current or short time obligations.

This information is gathered by the dealers from many sources, is summarized and presented to buyers of the paper for their information and files. The commercial paper dealer acts to transfer funds from where they accumulate, in banks, to commercial concerns and localities which can make profitable use of these funds. This function enables both the bank and the borrower to take good advantage of opportunities for business.

In the United States, commercial paper dealers do not endorse the paper they sell to banks, but guarantee the notes sold to be genuine. In other words, they do not guarantee payment of the paper at maturity. These dealers do not purchase indiscriminately, but handle the account of the borrower in much the same way as a bank, and act as fiscal agents for the borrower for his short time obligations. The service of the dealers is performed for a very small commission.

In Great Britain, where the trading is largely in acceptances, these being gathered together by brokers, each broker who handles the paper puts his name on the back so that when these acceptances are finally discounted in the Bank of England, they often have 10 or 12 endorsements.

It has long been a custom of this particular business that the banks and trust companies be allowed a limited number of days, usually ten, in which to check their credit information on the concern whose note they have bought. If this is not wholly satisfactory, the buying bank is allowed to return the note in question to the dealer, who will then buy it back. The obligation of the dealer to repurchase does not extend beyond the limited time of the option.

The relationship of commercial paper to the FEDERAL RESERVE SYSTEM is an interesting point. When the System was devised in 1914, it was felt that it would be especially desirable to serve particularly the commercial interest of the country, and therefore a clause was inserted providing that notes, arising out of commercial transactions and not having more than 90 days to run, might be rediscounted by a member bank with a Federal Reserve bank. Following this provision, a careful rule was prepared as to what should constitute paper eligible for rediscount, and

this rule has been amended from time to time; but the effect of the rule is to make commercial notes, of 90 days or less to run, serve as a substantially secondary reserve for banks who own such investments. Therefore, the carrying of a substantial amount of "paper" in the portfolio of a bank or trust company (*see* BANKS AND BANKING) gives it an ability to liquidate beyond that of most other forms of investment. The borrower, however, must be ever watchful not to exceed the safe limit beyond which he may be able to pay these short term obligations in times of stress. A new form of commercial paper is known as FINANCE PAPER. H. C. SM.

COMMERCIAL REVOLUTION, THE, the name given to a movement beginning about 1500 and continuing into the 17th century by which the character, methods and centers of European commerce were radically changed. The discovery of the Americas and of the water route to India made the Atlantic and Indian Oceans instead of the Mediterranean and Baltic Seas the chief avenues of traffic. Commercial supremacy departed from the Italian cities, Venice and Genoa, and from the HANSEATIC LEAGUE of northern cities, to be seized by the countries of Western Europe, first Portugal and Spain, then the Netherlands, England and France.

At the same time the character of European commerce was greatly altered. Larger, sturdier and more numerous ships ventured on long ocean voyages carrying bulky European products like salt meat, grain and woollens, and bringing home overseas merchandise, such as bullion, fish, sugar, dye woods, furs, tobacco, tea and coffee. New ports, as Lisbon, London and Antwerp, became the centers of this world trade. By 1600 these had far outstripped the old commerce of the Mediterranean, which was by its nature limited to costly and compact commodities.

Meanwhile there was a concomitant development of the methods and organization of commerce. Trade came to be dealt with on a national basis. The governments of western Europe by tariffs, bounties, regulations, the founding of colonies, navigation acts and, in fact, all the apparatus of MERCANTILISM sought to direct commerce into what to them seemed the most profitable channels. Giant chartered companies, such as the East India companies, instead of individual merchant houses, controlled the bulk of the new trade. To provide the necessary credit for the widespread operations banks were founded and banking methods improved. Joint stock companies enabled investors to take "shares" in commercial enterprises, even though they were not merchants. Better methods of bookkeeping were introduced. In short, the outlines of modern commerce and finance began to take form.

Of all the results of the new commerce the most obvious was a great influx of precious metals from overseas. Into Europe in the 16th century flowed somewhere in the neighborhood of half a billion dollars worth of gold and not much short of a billion dollars worth of silver. Europe's scanty monetary stock was increased many fold. Prices rose (*see*

QUANTITATIVE THEORY OF MONEY). Capital became plentiful. Wealth, luxury and ostentation grew immensely.

In the long run the changes wrought by the commercial revolution were manifold and important. European culture was spread over the world. In Europe wealth, comfort and knowledge increased, and modern business conditions began to appear. Most vital of all, the new power of money came to be concentrated in the rising middle class, which more and more sought to secure the social and political position to which its wealth seemed to entitle it. C. W. C.

BIBLIOGRAPHY.—W. C. Webster, *General History of Commerce*, 1903; E. P. Cheyney, *European Background of American History*, 1904; G. Unwin, *Industrial Organization in the Sixteenth and Seventeenth Centuries*, 1904; C. Day, *History of Commerce*, 1907; W. Cunningham, *The Growth of English Industry and Commerce in Modern Times*, 5th ed., 3 vols., 1910-12; Knight, Barnes and Flugel, *Economic History of Europe*, 1928; H. See, *Modern Capitalism*, 1928; *Cambridge Modern History*, Vol. I.

COMMERCIAL SCHOOLS in the United States were first established as private enterprises in answer to a growing need for organized training in commercial subjects. In 1894 courses in bookkeeping, shorthand and typewriting were introduced into the public high schools of a few of the larger cities with such success that commercial high schools were added to the public school system. The curriculum of the private commercial school is limited to commercial subjects and is intended for the student who wishes to specialize in these courses. The term of study varies from four months to a year. The curriculum of the public commercial high school includes the fundamental educational courses of other high schools in addition to the commercial training and covers the usual four-year period. The high schools have expanded their curriculum to include not only the traditional commercial subjects but commercial geography, elementary business training and retail selling. From 1922-28 there was an increase of 72% in enrollment in commercial subjects in the public high schools, and this enrollment is consistently increasing. An almost parallel growth in enrollment is found in the commercial courses introduced in the public evening high schools. In spite of the efforts of the private schools to raise their standards of admission and instruction, they have lost ground rapidly since the introduction of commercial courses in the public schools. *See also* BUSINESS ADMINISTRATION, SCHOOLS OF, COMMERCIAL EDUCATION.

COMMISSARY, strictly an official charged with duties of Army supply; generally, a store and its stock where, under the operation of the QUARTERMASTER CORPS, subsistence articles are kept for issue to troops or for sale to army personnel authorized to purchase it. *See also* SERVICE OF SUPPLY.

COMMISSION, in a military or naval sense, an official document, issued to an officer above the grade of warrant officer, evidencing the office and grade or rank in the Army or Navy occupied by the individual named in the document.

COMMISSION GOVERNMENT, a form of city government which came into vogue through its success as an emergency measure in Galveston, Tex., following the flood of 1900. *See also* MUNICIPAL GOVERNMENT.

COMMISSIONS, GOVERNMENTAL, in general, any governmental body of several members appointed to discharge a public task. They are quite commonly called boards, though in the United States commissions and boards may usefully be distinguished (*see* **BOARDS, ADMINISTRATIVE**). A commission has collegiate authority and responsibility, i.e., it must act as a body and each member is responsible for the conduct of the whole. The idea seems to be that affairs of great importance are more wisely entrusted to several than to one. The practice began in England under Tudor kings when the treasury was placed "in commission." In the United States, commissions are important both in federal and state governments. The theory of "separation of powers" is not strictly applied, as commissions may have judicial and legislative powers as well as executive or regulatory.

COMMITTEES, JOINT, in government, are made up of representatives from both houses of a legislature to act on matters of common concern. Such committees are infrequently used except in Massachusetts. The half-dozen joint committees of Congress deal with less important matters, printing, the library, employment of federal prisoners and the like.

BIBLIOGRAPHY.—A. Holcombe, *State Governments in the United States*, 1926.

COMMITTEES, LEGISLATIVE, the agencies which perform the bulk of the work of American law-making bodies. Bills are assigned for preparation and consideration to standing committees, or occasionally to special committees where hearings are held and bills either killed or reported out with or without amendments. The Senate has 33 standing committees, the House of Representatives 47. The parties are given a rough proportional representation on each committee, with the chairmanship in the hands of a majority member. The rule of seniority prevails almost without exception in committee assignments. Nominations are made in party **CAUCUS** and voted upon by the entire House.

BIBLIOGRAPHY.—R. Luce, *Legislative Procedure*, 1922; S. C. Wallace, *Our Governmental Machine*, 1925.

COMMITTEES OF CORRESPONDENCE. *See* **CORRESPONDENCE, COMMITTEES OF**.

COMMODUS, LUCIUS (161-192 A.D.), Roman emperor from 180 to 192 A.D., son and successor of **MARCUS AURELIUS**. An attempt on his life, 183 A.D., rendered him suspicious and tyrannical. He wasted enormous sums on combats between gladiators and wild beasts, even entering the arena himself. His generals gained minor successes on many frontiers. With his assassination the rule of the family of the Antonines came to an end.

COMMON CARRIER, a term applied to an organization or to a person, that transports goods for hire for the general public. Common carriers com-

prise those who transport both by water and land, including railway companies, truckmen, teamsters, porters, express companies, and the owners and masters of all water-craft who undertake to carry goods on hire. These are common carriers whether they carry goods from one country to another or merely from one locality to another. Common carriers are liable for all losses and damages to the property with which they are entrusted except that which results from an act of God or from public enemies, an act of God being something which is beyond human control and a public enemy a national enemy, including pirates but not robbers, gangsters and the like. Common carriers are not responsible for damage or loss resulting from negligence on the part of the shipper, as in packing, or from any fault of the goods themselves, provided they exercise reasonable care. Common carriers are required by common law to serve everyone alike and to carry goods for all that apply. They may be carriers of only a particular class of goods and in that event are compelled to carry nothing else, and they may qualify their responsibility by special contract. A **BILL OF LADING** is the usual written evidence of the agreement between the carriers and shipper. *See also* **CARRIER**.

COMMON LAW has a variety of meanings. In first instance, it refers to the law worked out by the King's Courts in medieval England, which was common or general for the whole realm, in contrast to the great variety of laws applied in local courts. The common law in this sense was worked out by the judges as disputes happened to come into court. Like our own judge-made law, it had an earthy, practical flavor, was little given to theory, was bottomed on practical common sense. But it also fell at times into rigidity, partly due to the temperament of judges, partly to the times. Yet there occasionally appear judges who take more pride in technical perfection than in bringing law in harmony with changing needs; judges who stay by the old at all costs, and who count innovation radical and dangerous. It is then that law gets out of line with slowly changing life. One help in England came by way of **EQUIVY**. Leaving the common law courts to deal with cases as their practice had been, the King's representative (later the Court of Chancery, or equity) could be induced nevertheless to step in and relieve a hard case. When especially at the beginning of the nineteenth century, that court also fell into the hands of a chancellor who believed firmly in the older precedents, equity came to resemble somewhat the common law it had come to cure, although equity was still more flexible and less tradition-ridden. And our law still holds—even though in most states the same court administers both—to the view that the road of equity can be used only when the common law road is recognized as inadequate to achieve justice. The most important characteristics of common law in this aspect are the right of either party to a **JURY** trial, while there is no such right in equity; and the absence of any machinery such as the **INJUNCTION** to prevent in advance a contem-

plated wrong. Common law waits until the damage is done, and relies chiefly on money DAMAGES to secure justice.

This common law strictly defined, is lumped together with equity and as "common or judge-made law" in a wider sense, is contrasted with the STATUTE laws made by the legislature. For the common law is the background against which the judges must set statutes in order to see what they mean. Nor is a statute ever a complete whole. It is full of gaps, left for the common law to fill in.

In a still wider sense, common law includes the strict common law, plus equity, plus the statutes as well, and is used to describe the ANGLO-AMERICAN LAW in contrast to the ROMAN LAW, or to the Continental systems. In contrast to the Roman law, which also was built up from disputed cases, this has reference to the divergence in institutions between the two systems, the much more systematic thinking of the Romans, their greater stress on family law, their lack of our important institution of trusts and trustees. In contrast with modern Continental systems, the reference is to the fact that these last are built, in the first instance, on cleanly worked out written codes, which attempt to cover most of the whole field of law; and that the Continentals think of the legislature as the center of the legal system. Whereas, common law countries set the judge and his work in the center, treating the legislature as dealing only with what it has expressly mentioned, and working the law out close to the facts, in little pieces, rather than in a single majestic sweep. The code-method leads to greater clarity. The common law method keeps closer in touch with the daily life, but is made unwieldy by the bulk of the decided cases. Interestingly enough, neither method alone has proved adequate, and the Europeans are adding a type of case-law to their codes, while we move progressively toward partial codification of our decisions.

The English common law had developed into a very adequate system by the time the American colonies were settled, and was at hand to be called upon from time to time. But as long as the colonists were either in rebellion against English institutions, or were faced with widely different conditions, the legal borrowing was haphazard and occasional. The expansion of the country in the early nineteenth century brought a press of legal problems that set a different picture. The judges turned to the easiest source, the English system, for legal materials. They took most of these, modified many, rejected a few. By the middle of the century, the common law system, including equity and the older English statutes, was firmly grafted upon this country, although with important divergences grown up with time, in the light of American problems. (See AMERICAN LAW.) And, though American legislatures are changing our law, still, the United States stands with the British dominions among the common law countries. K. N. L.

COMMONPLACE BOOK, a form of notebook kept for jotting down quotations, things especially to

be remembered and ideas to be expanded. It differs from the notebook in that the memoranda are arranged under heads, whether according to topic or alphabetically, providing more ready access to them. Many writers, among whom are CHARLES READE, ROBERT SOUTHY and CHARLES DICKENS, have kept commonplace books.

COMMONS, JOHN ROGERS (1862-), American economist, was born at Hollandsburg, Ohio, Oct. 13, 1862. Educated at Oberlin College and Johns Hopkins University, he taught political economy at Wesleyan University for two years, and became professor of Sociology at Oberlin in 1892. He was appointed professor of economics at the University of Wisconsin in 1904, and in the same year became director of the American Bureau of Industrial Research. He was a member of the Federal Commission on Industrial Relations during 1913-15, president of the American Economic Association in 1917, president of the National Monetary Association in 1922-23, and in 1923-25 chairman of the Unemployment Insurance Board of the Chicago Clothing Trades. Among his books are *The Distribution of Wealth, Regulation and Restriction of Output by Employers and Unions* and *Trade Unionism and Labor Problems*.

COMMON SCHOOLS, strictly all schools supported by general taxation and open to all. According to statistics issued by the United States Government, common schools include kindergartens, elementary and high schools, normal and vocational schools, evening schools, truant schools, and special type schools. Generally speaking, however, the term applies to the district school of the rural community and the elementary schools of the town or city, as opposed to the more advanced high school.

COMMON STOCK, the basic portion of the stock of a corporation usually representing control of its activities. A common stockholder is a partner in the enterprise and not a creditor. The company is not obligated to repay him to nominal value of his stock. Before the common stockholder is entitled to share in the earnings of a corporation, all interest upon BONDS and floating indebtedness and dividends on the preferred stock, must have been paid. His claim upon the ASSETS of the corporation also comes last. On the other hand the common stockholder is entitled to share proportionately in the earned profits. Dividends are usually determined by the directors (see CORPORATION LAW) and ratified by the common stockholder. Common stock is subject to wide fluctuations in value due to variation in earnings. While common stock usually carries power of control, since the World War some companies have put out "A" and "B" common stock, only one of which may carry the voting privilege. The actual value of a share of common stock has little or no relation to the nominal or par value. In recent years many large American corporations have issued NO-PAR STOCK, on the assumption that the wide disparity between the stated par value and market quotations misleads the public as to the actual value. See PREFERRED STOCK.

COMMONWEALTH AND PROTECTORATE. During the interregnum between the execution of Charles I in 1649 and the restoration of Charles II in 1660, England was at first a Commonwealth or Republic, governed by a council of state and unicameral parliament. The Protectorate began in Dec. 1653 when OLIVER CROMWELL became ruler with the title of Lord Protector which he held until his death in Sept. 1658. His son Richard inherited the office, but resigned in Apr. 1659.

COMMONWEALTH FUND, a fund established in 1918 by a gift of approximately \$10,000,000 from Mrs. Stephen V. Harkness "for the welfare of mankind." Further donations have increased the fund to about \$38,000,000. Both the principal and income are available. At first the fund carried out its activities through other agencies, but later conducted these through its own organization. Its main work has been in the fields of child welfare, health and education. In addition to the activities in America, the fund is carrying out a program of mental hygiene work in England and is providing fellowships to graduates of British and Colonial universities for two years' study in American universities.

COMMONWEALTH OF ENGLAND. See COMMONWEALTH AND PROTECTORATE.

COMMONWEALTH OF NATIONS, a term used to describe the political and constitutional relation between Great Britain and the self-governing dominions: Canada, Newfoundland, Australia, New Zealand, Union of South Africa, and Irish Free State. At the Imperial Conference of 1926, these dominions were defined to be "autonomous communities, within the British Empire, equal in status, in no way subordinate to one another in any aspect of their domestic or foreign affairs, although united by a common allegiance to the Crown, and freely associated as members of the 'British Commonwealth of Nations.'"

COMMONWEALTH RANGE. See ANTARCTICA.

COMMUNE. A general survey of medieval Europe reveals two principal classes of towns: those whose privilege was restricted to the social and economic sphere, and those which in addition enjoyed some degree of political autonomy. It is the latter that are more properly known as communes, but they can hardly be treated apart from the rest. For it was out of the ordinary community that the highly privileged type was evolved. Without elementary urban liberties, advanced urban liberties would have been impossible.

Evolution. The commune was thus a development. To understand it we must see, not merely what it eventually came to be, but how and when it arose. After a century of controversy among historians, it has come to be realized that the town of the Middle Ages, like the town of to-day, was a social unit, dependent for existence upon certain economic conditions. It did not begin as a legal principle. It was not a national institution. As Pirenne has pointed out, towns grew up in medieval Europe

as naturally as they have in modern America, and in response to the same forces. They were the product of a commercial revival that began to be felt in western Europe toward the close of the 10th century. Urban life, which had virtually died during the Dark Ages, spontaneously reappeared as trade and industry again flourished. The nucleus of the medieval town, wherever it happened to be, was generally a mercantile settlement, a new colony of business men and laborers.

For the creation of such a settlement in such an age there were at least two prerequisites: a favorable location for trade and a defensible position. Throughout the regions that had once been Roman provinces it was usually the old city (*ciuitas*) that again attracted an urban population. With the decline of ancient civilization the city had lost its economic prosperity, its political privilege, and most of its inhabitants. But under the rule of a local lord, usually the bishop, it had preserved some importance as a fortified refuge and an administrative center. Now, as commerce once more flowed along its previous course, it was natural that the city should again come into its own. Many Roman towns, like Nîmes, Augsburg, Cologne, Bordeaux, Paris and York, rapidly became greater than they had ever been under the Caesars. But the old cities did not all revive; and alongside them rose a host of entirely new foundations.

The extension of western culture beyond the Rhine had stimulated an unprecedented growth of trade along the German rivers and through the Baltic; so that countries which had lain desolate in Roman times now witnessed a remarkable expansion of mercantile activity. Here there were no cities, but here had been erected many of the smaller fortresses called castles or, in districts where Germanic dialects prevailed, burgs. Originally built as defenses against the Northmen and other invaders of the 9th century, they had developed into royal or feudal strongholds that dominated the surrounding territories. They were not in themselves towns, but their strength and strategic position often induced merchants and artisans to establish themselves on waste lands beyond the walls. Thus arose in Flanders the new trading settlements of Ghent, Bruges, Arras, Saint-Omer and Ypres; and in Germany, of Magdeburg, Osnabrück, Goslar, Erfurt and many others. And similar developments were not uncommon also in the old provinces of Gaul, Britain, Spain and Italy.

As already noted, the castle in Germanic lands was called a burg; but the name was also applied to any other fortified enclosure, such as an old Roman city or a defensible dwelling. The new mercantile settlement, because it was surrounded by an earthen rampart and a stockade, was likewise a burg; and with this application the usage spread even into Latin-speaking countries. Thus by the 12th century burg, borough, bourg, and similar terms came regularly to mean a town; bourgeois, burgher, and burges, to mean a townsman. The word city was still reserved for a town of Roman origin or one en-

dowed with a bishop; but its citizens were only a variety of bourgeois.

Meanwhile the victory of the new word was matched by the triumphant advance of the mercantile settlement. From a position of subordination it frequently came to dominate the whole neighborhood. Many an ancient burg or castle was lost to view in the center of a huge new burg; the walls of many a Roman city were encircled by fortified suburbs and so, becoming useless, were eventually razed. This in brief is the topographical history of practically every great town of medieval Europe. And as the town grew, it developed its own peculiar institutions.

Development of New Towns. From the outset the bourgeois tended to be distinguished from the peasant by his legal and economic freedom, for his calling was wholly incompatible with the manorial régime of the countryside. He demanded mobility for himself and for his property. His lands, unlike those of agrarian or military tenants, were charged with no service beyond a fixed rent and bound by no restrictions on alienation, the system of tenure known in England as *burgage*. Many lords, such as the counts of Flanders, the dukes of Normandy, and the southern French princes, generally favored the mercantile classes from the beginning, and under them privileged bourgeois communities emerged long before municipal charters came to be granted.

The latter, in fact, very rarely describe with any fullness the liberties of the old towns. To find a complete statement of elementary urban privilege we must turn to such a charter as that of Louis VI, 1100-37, for Lorris or that of Conrad of Zähringen for Freiburg im Breisgau, 1120. In a document of this sort an entirely new town is created. Each settler is given a building plot at a low fixed rent, to be held by free urban tenure. No matter what his previous condition, he is promised personal liberty if he resides in the town without challenge for a year and a day. He is to be exempt from ordinary manorial obligations, such as forced labor, unlimited military service, arbitrary taxation, and restrictions on marriage and inheritance. He is guaranteed trial in the town according to the special law there in force. And he is encouraged to engage in trade by the offer of particular advantages in that field.

Political Aspects. Thus the bourgeois status that had gradually evolved in older communities during the 11th century was extended to a host of new ones during the 12th and 13th. But in the meantime the former had already advanced beyond the elementary stage. The great town tended to become, not only a privileged social body, but also a political corporation, managing its own affairs through its own elected magistrates. This result was often attained gradually and with the encouragement of the lord, who realized that enormous profit would accrue to himself through the stimulation of local enterprise. By the early 12th century the leading towns of Flanders, Normandy, Guienne and Languedoc all seem to have se-

cured self-government peaceably. It is only in particular regions and as the result of peculiar circumstance that municipalities arose by insurrection. However, these towns, though exceptional, were very famous, and to their example is due the popularity of the term *commune*.

The commune was at first a revolutionary organization, a sworn union to secure by force liberties that otherwise seemed inaccessible. It was the product of seigniorial opposition. Most ecclesiastical lords, being intensely conservative in economic matters, proved hostile to the urban movement, and their uncompromising attitude frequently drove the bourgeois of their cities to violence. Throughout Italy we hear of insurrectionary communes against episcopal authority beginning early in the 11th century. With no efficient royalty to save them, the bishops were forced to submit, and by 1100 the communes of Milan, Pavia, Brescia, Florence, Genoa, etc., were already free of seigniorial control.

To the north the first similar outbreak occurred in 1076 at Cambrai; but in spite of long continued disorder, the city did not win final victory until the later 12th century. And by that time the contagion had spread throughout Picardy. At Saint-Quentin, Amiens, Laon, Beauvais, and in many other episcopal cities, communes were proclaimed which, often through the intervention of the liberal Louis VI, came to be formally recognized. In Germany, on the other hand, the emperor generally supported the bishops; so the municipal ambitions of their cities, except at Cologne, long remained thwarted. In England, likewise, most of the boroughs were still too small in the 12th century to demand more than the king freely gave them. It is only in London, and only during times of civil disturbance, that a commune is heard of on that side of the Channel.

By its success, therefore, the commune which had begun as an insurrectionary association of citizens, in the eyes of clerical annalists a conspiracy (*conjuratio*), became a permanent institution, a self-governing town. And with such a meaning the name was frequently given to 12th century municipalities which had developed altogether peaceably or which were created out of hand by charter. In any case the final result was much the same. The first-class town obtained autonomy primarily through the substitution of elected for seigniorial magistrates.

Eventually the commune evolved an elaborate constitution, with a hierarchy of officials and councils; but originally the government was very simple. A group of selectmen, called consuls, peers, *echevins*, *juries*, and the like, exercised all functions, naming subordinates and perhaps a presiding officer, administering justice, issuing ordinances, superintending walls and streets, collecting tolls, levying local taxes, and doing whatever else was necessary. And when the system arose, it was essentially aristocratic. Actual power was held only by the more substantial men, the same persons who often controlled urban trade through a guild merchant. The rôle of the populace,

assembled in the marketplace or church-yard, was merely to applaud the decisions of the leaders. Whatever more democratic features the medieval commune came to possess were the result of social uprising in a subsequent period.

Independent Republics. To describe the latter fortunes of the communes is impossible in a brief article, for each group had its own history, depending upon its own political environment. With the weakening of the Holy Roman Empire, the communes of Italy and Provence became virtually independent republics as early as the 12th century; and in another hundred years the imperial towns of Germany came to enjoy much the same liberty. In the Sicilian, French, Spanish and English kingdoms, and in the German principalities, the fate of the towns was determined by the relative strength of the central Governments. The more powerful monarchies kept the towns thoroughly subordinated, but allowed them considerable local autonomy and normally taxed them only through polite negotiation for separate grants, a practice that ultimately led to their representation in the great central courts.

More generally, the development of the towns tended, not only to affect constitutional government, but to revolutionize society and culture. The emancipation of the middle class preceded and stimulated that of the peasantry. Serfdom disappeared earliest in those regions where commercial activity was most dominant. And it was more than coincidence that the years which saw the revival of urban life saw also the tremendous advance in learning, literature and fine arts that has made the Middle Ages illustrious. The rise of the bourgeoisie, quite apart from the sporadic violence of the insurrectionary commune, marked the beginning of a new epoch in the history of European civilization.

BIBLIOGRAPHY.—H. Pirenne, *Les Villes du Moyen Age*, trans. as *Medieval Cities*, 1926, and his chapter in *Cambridge Medieval History*, vol. VI, 1929; chapter by C. W. Previté-Orton, *Cambridge Medieval History*, vol. V, 1929; C. Stephenson, *Borough and Town*, 1932.

COMMUNICATION, the transmitting of feelings, attitudes, sentiments and ideas from one person to another. The elementary forms of communication are expressive of emotion, gesture and language. Writing, printing, the railroad, the telephone, the telegraph, the automobile, motion picture, the airplane and the radio extended the range of communication and increased the rapidity of its transmission.

The rôle of communication in the organization of society has been clearly stated by John Dewey. "Society exists through a process of transmission . . . by means of communication of habits of doing, thinking and feeling from the older to the younger. Without this communication of ideals, hopes, expectations, standards, opinions from those members of society who are passing out of the group life to those who are coming into it, social life could not survive."

The invention of writing is perhaps the decisive criterion for determining the beginning of civilization. The printing press has been held by historians

to mark the transition from medieval to modern society. In his book, *The Great Society*, Graham Wallas interprets modern society as a creation of the machine and of artificial means of communication.

Of the artificial devices of communication, the newspaper, the railroad and the telegraph have determined the characteristic features of the organization of economic, social and political life. Social changes now in progress are largely due to the effects of the automobile and the airplane, the motion picture and the radio in extending the range and rapidity of communication. They have accelerated urbanization, not only by breaking up the earlier neighborhood type of organization but by increasing the economic and social dominance of large cities. They have powerfully aided the economic tendencies toward integrating rural and urban areas into metropolitan regions. The subtle but profound changes in habits of life due to the automobile, the motion picture and the radio are only in process of study. It is significant that all, with the exception of railroads, show a rate of increasing use greater than the rate of population increase. More recent facilities like the automobile, the airplane, the motion picture and the radio are increasing more rapidly than newspaper circulation, telephone calls and number of telegrams. While competition still continues between the older and the newer forms of communication, e.g., between the railroad, motor vehicles and the airplane, there are evidences of attempts at integrating these and other forms of communication in the interests of efficiency and of diversified service to the public. E. W. B.

BIBLIOGRAPHY.—Graham Wallas, *The Great Society*, 1914; John Dewey, *Democracy and Education*, 1916; W. F. Ogburn, Ed., *Social Changes*.

COMMUNICATIONS, U.S. NAVY. The Chief of Naval Operations directs the operation of the naval radio service and other methods of communication. Under him is the Director of Naval Communications, who is charged with the administration, organization and operation of the entire radio, telegraph, telephone and cable systems of communication within the naval service, including the operation of the transatlantic radio system and all communications between merchant ships and all shore stations of the United States and its possessions. The foregoing includes the preparation and distribution of all codes, ciphers and secret calls, and commercial accounting. The Director handles all matters pertaining to radio communications, except those relating solely to purchase, supply, test and installation of apparatus. The communication office handles all telegraphic and radio communications to and from the Navy Department. With the advent of radio, the importance of naval communications steadily increases. In time of war, the office of Naval Intelligence has charge of the censorship of cables and radio. See also **NAVAL OPERATIONS**, **CHIEF OF**. R. E. C.

COMMUNISM, an extreme form of **SOCIALISM**. In early times this term applied to movements aimed toward the pooling of property resources on a small

scale with all sharing alike in the product. Such movements differed from anarchist efforts in that a governmental agency was to be set up with title to all property vested in it. Certain of the early Christian groups, and many of the Utopian movements (see *UTOPIA*) sponsored communist beliefs. Small scale experiments in communistic colonization have been numerous.

The communist movement of the present day, however, received its impetus with the writings of KARL MARX and FRIEDRICH ENGELS. These men put into dynamic form their belief in the impending collapse of the capitalist system (see *CAPITALISM*) and the rise of a new social order. Followers of Marx have differed as to his attitude. Two outstanding groups exist. The socialists hold that Marxism does not contemplate the use of violence in seizing power and, therefore, wish to use democratic methods in erecting the new system. This group claims a line of descent from the communists of the 1840's who were, in reality, socialists. The communists believe that the inevitable decay of the capitalist system requires the organization of a small well-tested and alert nucleus of class-conscious workers whose purpose must be to point out the faults of DEMOCRACY under a capitalist regime; that when the inevitable CRISIS comes (due to a glut of goods or to the excesses of warfare), the well disciplined communist minority should be in a position to wrest political power from the discredited capitalist leadership (its agents planted in the factories and in the armies and navies will, it is hoped, turn the military power against the exploiting class); and that once power has been attained by the militant communist minority, a dictatorship of the proletariat will be established under which the essential means of production, including all material resources, will be taken over by the state under a military communism. This organization would continue until the exigencies created by the threat of counter-revolution are past. The communist leadership would, moreover, undertake the extermination of privileged classes, the education of the masses, and the erection of a highly integrated and closely coordinated economic system.

Communists hold that this is the ultimate state of society—one in which classes will be wiped out, all exploitation will have disappeared and the equal liability of all to labor and the collective ownership of the means of production are established.

The Russian revolution created a stormy battle as to the future of communism. This overthrow did not appear in the "ripe" situation which Marx had anticipated. Rather it occurred in a primitive agricultural community. One wing of the communists, led by LEON TROTSKY, felt that the overthrow of capitalism must soon come and that Soviet Russia should bend her efforts toward the extension of the class struggle into other areas. JOSEPH STALIN though he upheld the view that communism will finally prevail, felt, nevertheless, that steps must be taken to place Russia in such a firm position that the final

overthrow will be assured. Stalin says "We are going full steam ahead through industrialization toward socialism. We are becoming a land of metals, of automobiles and tractors, and when we put the Union of Socialist Soviet Republics into a motor car and the muzhik into a tractor, then let the revered capitalists who pride themselves on their 'civilization' try to catch up with us."

Much of the dynamic is given to the communistic program by a faith in the potential power of the propertyless classes, once they have been emancipated from their present position. In essence, the differentiating characteristic between the communistic and socialist programs of today lies in the belief of the communists that emancipation from "wage slavery" can come only through a social cataclysm; that the entrenched banking and business interests will not give way to the Fabian program without a struggle; that democracy is a sham and a farce, and that a "catch-as-catch-can" battle must be waged until the final victory of the proletariat is at hand. The Paris Commune and other unsuccessful revolutionary uprisings are celebrated as forerunners of the final triumph. C. E. W.

BIBLIOGRAPHY.—N. Burkharin and Preobraschensky, *A. B. C. of Communism*, 1919; J. Stalin, *The Theory and Practice of Leninism*, 1925; N. Lenin, *The State and Revolution*, 1926.

COMMUNIST MANIFESTO, a famous pamphlet sometimes called "The birthcry of modern Socialism" prepared by the two great Socialist leaders KARL MARX and F. ENGELS, published early in 1848, setting forth in vivid and concise terms the doctrines of Marxian Socialism. Its concluding sentences have long been the battle cry of Socialism. "The proletarians have nothing to lose but their chains. They have a world to win. Workingmen of all countries, unite!"

BIBLIOGRAPHY.—Marx and Engels, *Communist Manifesto*, 1848.

COMMUNITY CHEST, a cooperative organization of the social welfare interests of a community for the planning of the social welfare program and for financing all that part dependent on voluntary contributions. The planning of programs is done by special committees dealing with the various fields of dependency, delinquency, sickness and leisure time. These committees sometimes unite in a council of social agencies as an intermediary between the organizations rendering welfare services and the body responsible for raising and appropriating the funds and known as the Chest.

Community chests came into existence in 1913 in Cleveland, O. Here for the first time a single organization decided how much should be raised for a group of welfare agencies and how this total should be apportioned among them. During the World War many communities formed similar organizations for raising funds incidental to the war, but at the close of the war only a score of organizations persisted, raising about \$10,000,000. The community chest movement is a development of the third decade of

the 20th century. Some 30 new chests were organized during 1931, all in smaller communities, and at that time there were 177 chests in cities of 50,000 and over out of a possible 221.

A. T. B.

COMMUNITY ORGANIZATIONS, bodies concerned with community welfare. From early times the school house has been used by the community for certain social purposes. In 1907, E. J. Ward organized in Rochester, N.Y., the first formal comprehensive scheme of utilizing the school building for a social center in which the people of the neighborhood were brought together for civic, social, cultural and other cooperative enterprises. In 1911, the idea was approved in a resolution of the National Education Association. Since then legislation in nearly every state has been authorizing and regulating such use. In 1924 a study was made through the U.S. Bureau of Education, in which 1,569 school centers were listed in 722 localities.

Extension departments of universities, state departments of public instruction, the National Recreation Association, the National Congress of Mothers and Parent-Teacher Associations and other organizations to less extent are fostering community centers. They are controlled largely by boards of education, but in lesser degree by private organizations. The activities conducted are, in the order of frequency, athletics, clubs, entertainments, social meetings, lectures, civics, dancing, night school and cooperative activities.

The idea and program of the community center have been adopted by organizations which seek to serve communities that are new or under-privileged and in which satisfactory social relations have not evolved. Churches are foremost in this sort of service, offering activities with varying degrees of freedom from proselyting motives. The National Community Center Association represents the community centers as a whole. In a few instances there are state organizations. The term community council is used for a variety of organizations, including a few councils of social agencies in which each agency represents a city-wide service; organizations of individual citizens very much resembling community centers; and civic councils organized to advance the whole social welfare, or some few phases of it, of a district in a city, a town or a county, and composed of one or more officers or representatives of all or the leading organizations in the territory served. There is no national or regional coordinating body. During the World War the Council of National Defense stimulated appointment of state councils by the governors. The state councils organized county councils, and lastly, with the co-operation of the U.S. Bureau of Education, local community councils were formed. It is said there were 180,000 at the time of the armistice. Very few of them adapted themselves to peace-time programs.

As an outgrowth of settlement work and in an effort to reach the results of settlements in poor districts by the use of indigenous forces in more democratic fashion, neighborhood associations were formed in a very few instances. They were a pre-war de-

velopment and while they were of long life they did not increase in numbers. They conducted civic, educational, health, cultural and some forms of relief work and were a forerunner to and an aid in the development of health centers.

The many forms of community organization have been the formulated and organized answers to the need of a means of meeting common problems in a changing social environment. Immigration, urbanization and the weakening of old neighborhood and other ties brought hordes of people face to face with new forms of social, civic, recreational, political and other problems. The first efforts of the neighborhood or district groups to meet common needs, despite their heterogeneous background, are the history of community organizations.

LER. E. B.

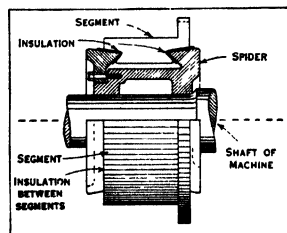
COMMUNITY PROPERTY, a property system which arises from the marriage relationship and implies two concepts—that of property owned by the two members of the marital community, known as community property, and the separate property of each. It prevails in Arizona, California, Idaho, Louisiana, Nevada, New Mexico and Washington.

The system came to us from French and Spanish law. The sources of financial gains are the earnings of the spouses and profits from investments, acquisitions by settlements on public lands, proceeds of insurance policies, and gains from other sources.

In seven of the states the wife has a vested interest in the community property, though the husband is the manager. California law has been more nearly like Mexican law, until recent statutory changes were made, and it has been held that the wife, during the continuance of the marriage, has a mere expectancy which becomes a property right only if she survives the marriage relation. If the wife's interest is regarded as vested, separate Income Tax returns may be made by the spouses, and thus the Federal Surtax may be reduced.

A. E. E.

COMMUNITY THEATERS. See LITTLE THEATER MOVEMENT IN AMERICA.



QUARTER-SECTIONAL VIEW OF
COMMUTATOR

COMMUTATOR, that portion of a rotating ARMATURE of a direct current electric generator or motor which functions to connect the armature conductors to an external circuit. In the generator, the commutator acts to rectify the alternating current pro-

duced in the armature conductors; and, in the motor, it serves to produce the necessary alternations in the direction of current flow in the conductors. The commutator consists of a cylindrical arrangement of wedge-shaped copper segments insulated from one another and from the supporting spider (see figure). The segments are soldered to the conductors and stationary brushes bear upon the surface of the commutator to form an intermediary connection between the segments and conductors and the external circuit. See also DYNAMO-ELECTRIC MACHINE.

COMNENIAN DYNASTY. The political chaos which marked the close of the Macedonian dynasty threatened, along with attacks from Bulgars, Normans, and Turks, to bring about the collapse of the Byzantine state. Revival was effected by Alexius Comnenus, who seized the imperial throne in 1081. His family retained the crown until 1185. The founder of the dynasty repelled the Normans, and, thanks to the First Crusade, recovered Asia Minor from the Turks. His successors extended an uncertain and temporary overlordship over the crusader states in Syria. In order to get help against the Normans extensive trade concessions were made to the Venetians, which enabled them to secure a serious hold upon the economic life of the empire. Attempts of the Comneni to revoke these concessions served only to excite the Venetians' hostile fears and so to bring about the overthrow of the Byzantine Empire by the Fourth Crusade, 1204.

COMO, a city of northern Italy, capital of the province of the same name, situated on the southwest shore of LAKE COMO. It lies in a valley surrounded by wooded mountains near the Swiss frontier and on the St. Gotthard Railway. The industrial suburbs extend from the rectangular old city, surrounded by walls, into the valley along the shores of the lake, while the pleasant villa sections are on the slopes of the hills. Foremost among the buildings is the medieval cathedral begun in Gothic style and completed in the Renaissance. Nearby is a picturesque gate tower, the Broletto, the Museo Civico, and the 11th century basilica of Sant' Abbondio. There is important, highly diversified industry, silk manufacture being most prominent; and brisk trade, necessitating much transit traffic on Lake Como. To the south of the city are the ruins of the Castle Baradello, which formerly shut off the entrance into the Lombard plain, and to the north is the high terraced Brunate with numerous hotels and villas. The Roman *Comum*, Como was an important trade center in ancient times. In the party warfare in upper Italy in the 12th century, it sided with the Ghibellines, allies of the Emperor Frederick Barbarossa, and later fell into the power of Milan. Como was the birthplace of Popes Innocent XI and Clement XIII. Pop. 1931, 54,138.

COMO, LAKE, one of the famous lakes of northern Italy, situated on the outer margin of the southern Alps. Lake Como has an elevation of 650 ft., an area of about 55 sq. mi. and a maximum depth of

almost 1,400 ft. Its greatest breadth is 2½ mi., and its length some 40 mi. In shape it resembles an inverted Y, as it is composed of three reaches; the two southern arms divide at Bellagio, the eastern being called Lecco, and the western, Como. The principal affluents are the Adda and the Maira rivers which carry down water from the Alps; the Adda flows out at its southeastern extremity. Como is the largest town on its shores; others are Cadenabbia, Bellagio, Menaggio, Lecco and Cernobbio. Fish are plentiful, and silkworm culture is the region's chief industry.

From antiquity onward writers have paid tribute to Como's charm and color. Ruined castles, villas, tiny fishing villages, lovely gardens and groves of olive, mulberry and walnut trees make a harmonious blend here.

COMORO ISLANDS, a group of islands in the Indian Ocean, lying 200 mi. from the east coast of Africa and 350 mi. northwest of Madagascar. The largest of the group, which belongs to France and comprises a total area of about 650 sq. mi., are Great Comoro, Anjouan, Mayotte and Moheli. These islands are mountainous and of volcanic origin. The soil, except that of Great Comoro, which is arid, is very productive and vanilla, cacao and perfume plants are cultivated and fine timbers are exported. Cattle and sheep are bred. The chief industrial establishments are sugar refineries and rum distilleries. The main exports are sugar and vanilla. Mossamonda is the capital. Combined pop. 1925, 119,395, including 804 Europeans.

COMOX, a tribe speaking one of the dialects of Coast Salish. They lived on Discovery Passage between Chancellor Channel and Cape Mudge, Brit. Col.

COMPANY, a unit of INFANTRY composed basically of a HEADQUARTERS and two or more PLATOONS. It is, generally speaking, the basic unit in infantry organization as it comprises several tactical units and provides agencies for their administration. In the infantry there are headquarters companies, rifle companies, machine gun companies and howitzer companies. The rifle company, war strength, consists of six commissioned officers and 193 men. The machine gun company consists of 172 men and has 12 guns. The howitzer company has three 37-mm. guns and three 3-in. mortars.

The word company is one of the oldest military terms. In the 16th century the French gendarmes were organized into companies and it was at a later date that it was applied to infantry organizations, and corresponds to a troop of CAVALRY and a battery of ARTILLERY.

BIBLIOGRAPHY.—U.S. War Department, *Tables of Organization*.

COMPANY UNIONS, organizations of workers in a single plant or corporation, usually organized at the instance of employers. They elect their representatives who meet the employers' representatives for COLLECTIVE BARGAINING to fix WAGES, hours and conditions of work. They are not a part of the union movement (see LABOR ORGANIZATION); in most cases

their members are not permitted to join trade unions. Many employers introduce company unions to preclude this necessity. The labor unions condemn the company unions on the ground that they are company controlled and that representatives of a company union, who must always be employees of the company, may be bribed by prospects of promotion or frightened by fear of dismissal so that they cannot fearlessly and adequately represent their fellow employees. See also EMPLOYEE'S REPRESENTATION.

BIBLIOGRAPHY.—*The Shop Committee in the United States*, 1923; E. E. Burton, *Employees Representation*, 1926.

COMPARATIVE ANATOMY is the study of the structures of a series of animals, or of plants, pursued with a view to determine their fundamental resemblances or homologies. It arose as a distinct science before evolution was generally accepted and was then employed to work out general types of organization to which it was assumed that human and other animal bodies would conform. With the rise of comparative embryology the development of a structure was often found to shed light on its phylogenetic origin. Comparative anatomy and embryology are sometimes merged under the term MORPHOLOGY, the study of structure, in contradistinction to PHYSIOLOGY, the study of function.

In practice the function of an organ is seldom lost sight of when tracing its modification in phylogeny. Some illustrations may be taken from the animal kingdom. Oxygen required by all tissues to live is brought to them in most multi-celled animals by the blood. In animals with a body cavity the blood is carried in vessels which may be surrounded by muscular walls capable of contracting and propelling the blood. In many invertebrates and all vertebrates a limited portion of one of the vessels becomes especially muscular and is known as the heart. In arthropods and mollusks the blood vessels do not form a continuous system, but the arteries, the vessels leading away from the heart, are separated from the veins, the vessels leading to the heart, by spaces in the tissue across which the blood flows. In annelids, echinoderms and the chordates, connecting vessels, the capillaries, usually of fine calibre, occur between arteries and veins. In primitive vertebrates and embryos there are four longitudinal vessels running the length of the animal's body. A cardinal vessel extends along each side wall of the body, a subintestinal occurs in the ventral wall of the gut and a dorsal aorta is found immediately below the vertebral column. At the anterior end the subintestinal connects with the dorsal aorta by paired vessels, the aortic arches, which extend between the gill slits.

Although respiration, that is, interchange of gases between the living tissues and the environment, can take place on any part of any animal's body where thin walled blood vessels come close to the surface, the earliest vertebrates, the ostracoderms, were heavily armored with bony plates or scales and respiratory exchange was restricted to the exposed gill slit region. The epithelium covering the walls of the slits was

extended into vascular processes, which had the same function as the gills found on many parts of the body of invertebrates. To judge from the conditions in the cyclostome descendants (lampreys) of ostracoderms the blood aerated in the gills of the latter was propelled back along the dorsal aorta into the capillaries of the intestine or body wall. While the subintestinal vein returned the blood directly to the heart, situated immediately posterior to the gill slits, the blood in the cardinal veins had to make its way across the body cavity by a special vessel, the Cuvierian duct, which lay in a transverse septum. In all higher vertebrates this series of four longitudinal vessels is modified in various ways. The kidneys grow in the path of the cardinals, the liver across the route of the subintestinal with the result that the blood is forced to make a detour through the capillaries of these organs. In embryos with large yolk sacs the subintestinal is further split into two vitelline veins. With the development of limbs subclavian veins appeared anteriorly while an additional pair of longitudinal veins, the laterals, carry the blood directly from the hind limbs to the Cuvierian ducts.

The modification of the vascular system in vertebrate evolution is closely correlated with function. With the appearance of lungs in phylogeny a pulmonary vein was formed to carry the oxygenated blood back to the heart. The latter also receives poorly aerated blood from various parts of the body. To increase the efficiency of respiration it was necessary to separate the well-aerated blood from the poorly aerated. The hearts of the various vertebrates living to-day indicate how this important change was accomplished. The heart of fish primitively consists of a single tube constricted into four parts: from behind forward these are sinus venosus, atrium, ventricle and truncus. In modern *Amphibia* the atrium is divided by a more or less complete longitudinal septum into two auricles and the blood from the lungs passes into the left auricle and is directed into the left side of the single ventricle. The poorly aerated blood received from the right auricle is forced from the right side of the ventricle into the truncus where a spiral valve directs it to the pulmonary artery leading to the lungs. The oxygenated blood from the left side of the ventricle is turned by the action of spiral valve and truncus to the vessels leading to the head. A few reptiles, namely the crocodiles, have a longitudinal septum dividing the ventricle into right and left halves, thus separating the aerated from the non-aerated blood, and in all reptiles the truncus is split into three vessels, a pulmonary, a left systemic and a right systemic arch. The ventricular partition was made in such a way that the right systemic which springs from the left side of the ventricle receives all the oxygenated blood while the poorly aerated blood flows to both the pulmonary and left systemic arch. Since both right and left systemics carried blood to the head and dorsal aorta, the aerated and non-aerated blood were sent mixed to the head of the animal. The birds, which as

their warm blood indicates have risen to a higher level of respiratory efficiency than the crocodiles, got rid of this mixing by eliminating the left systemic arch. The mammals, although also warm blooded, sprang from another group of reptiles which apparently never divided the truncus into three vessels but only two. As shown in the development of the mammalian heart the truncus splits into a pulmonary and a common systemic arch from which there spring anteriorly the right and left systemics, both carrying oxygenated blood. As development continues, the right systemic, apparently being unnecessary, is lost.

Another illustration of comparative anatomy may be taken from the urinogenital system. The waste products of protein metabolism are eliminated by the kidneys chiefly in the form of urea or uric acid. In the larvæ of various invertebrates the kidneys are tubes opening to the exterior at the outer ends and terminating in a ciliated cell, the so-called flame cell, at their inner ends. These cells pass nitrogenous waste materials into the lumen of the tubules. In the adults of various annelids the inner ends of the tubules, or nephridia, open into the body cavities. Nephridia with flame cells appear in *Amphioxus* but the kidneys of all vertebrates are built out of the modified type found in some annelids, mollusks and a few other invertebrates. In all vertebrates the body cavities have lost their primitive segmentation by fusing to form a larger cavity or coelom. Nevertheless the body muscles and kidney tubules retain evidence of the primitive segmentation. Although vertebrates presumably arose in salt water, for their body fluids retain salts in about the same concentration as in dilute sea water, the early ostracoderms made their way into fresh water where it was necessary to continually regulate the fluidity of the blood by throwing off the excess water absorbed by the tissues. A thin walled, vascular diverticulum, or glomerulus, developed near the end of each tubule to filter off the excess water. The outer ends of the tubules also become modified, for in all vertebrates they are fused to form an archinephric duct on each side opening in or near the cloaca. Larval life in the water necessitates an early functioning of the kidney. The nephric tubules originally segmentally arranged throughout the body became early differentiated in some of the anterior segments of the trunk. The resulting pronephros became specialized in most vertebrates in that the ends of the tubules opening out into the body cavity widen during development and each glomerulus is not included within a tubule but projects from the adjacent wall of the body cavity. The tubules of the more posterior body segments when they appear form a mesonephros. These tubules may undergo secondary multiplication and in some *Amphibia* (caecilians) and all higher vertebrates one or more outgrowths of the archinephric duct extend to the posterior kidney region and fuse with the developing tubules to form a metanephros. A pronephros is either reduced or lacking in reptiles, birds and mammals since they have no larval stage. In

these the metanephros functions as the kidney and the tubules lying immediately anterior, those of the so-called mesonephros, are taken over to form an important part of the genital system of the male.

Sexual reproduction in both animals and plants consists in the fusion of the nuclei of two cells from which a new individual develops. The sex cells are widely scattered through the mesoderm of sponges but in most higher animals they become aggregated into definite organs, the ovaries and testes. In many invertebrates ducts are present making possible the release of the sex products to the outside where fertilization often occurs. In vertebrates the nephric tubules or their ducts serve this function. With the linking of the reproductive and excretory systems in the earliest vertebrates or their immediate ancestors, various changes occurred to increase the efficiency of this system. A Mullerian duct was split from the primitive archinephric duct for the release of the eggs. In higher vertebrates, where the eggs may be retained within the body of the mother for varying periods, the Mullerian duct may fuse posteriorly with its mate of the opposite side to form a uterus. In the cyclostomes the sperm, like the eggs, are shed into the body cavity and find their way to the outside through genital pores of uncertain origin. In all higher vertebrates tubules extend from the mesonephros to the testis and serve as conduits for the male products. In various fishes and *Amphibia* the nephric tubules thus incorporated into the reproductive system may lose their excretory function and this is also true of all *Amniota*. In some fishes and a few *Amphibia* the sperm is deposited into the cloaca of the female by the male. Modified fins may be used for this purpose in fish, or a tubular extension of the male cloaca in *Amphibia*. In the reptiles a mass of erectile tissue develops in the floor of the cloaca and this may be everted to serve as an intromittent organ. The penis of some birds and all mammals represents a further modification of this organ.

One of the most enlightening methods of comparative anatomy is to correlate the paleontological record with the anatomical and ecological data. The history of the vertebrate animals, for example, represents the series of attempts made by one group of animals to gain control over their environment. This history may be briefly reviewed for it illustrates one of the modern tendencies in comparative anatomy. The oldest true vertebrates are jawless, fish-like ostracoderms of the early Palaeozoic. The skin of many ostracoderms was well-provided with an armature of bony plates, or scales, which they inherited possibly from echinoderm ancestors. The bilge keels on the bodies of some ostracoderms may have gained a cartilaginous support, for the immediate descendants of the ostracoderms, the old ganoids, had paddles and also jaws. The latter they had apparently fashioned out of the first pair of cartilages supporting the gill clefts. During Devonian times some of these primitive fish found themselves in the muddy waters of

a rapidly drying continent. The gills inherited from ostracoderms were not an adequate respiratory mechanism and since the body was still covered with an armature of scales these fish developed a vascular diverticulum of the last gill pouch as an accessory respiratory organ. Air was gulped back into this lung rudiment where gaseous exchange could occur. These armored fish of the Devonian also developed a supporting skeleton for their paddles, consisting of a proximal segment abutting against a supporting bone in the bony wall. Distal to the proximal piece were two elements followed by a series of smaller ones. This is essentially the arrangement of the bones found in the limbs of all later vertebrates, for these inherited their skeleton from this line of air breathing fish. By early Carboniferous times these fish had lost their gills and had taken up life on land. They had become the first land vertebrates, the early tetrapods (Quadrupeds).

Life on land affords the advantage of increased supply of oxygen and greater illumination for vision but the drying effect of the winds and the daily and seasonal changes of temperature are a decided disadvantage. Life on land made possible the improving of sense organs and brain. It also demanded more efficient limbs to take advantage of the new terrestrial abodes and improved nervous mechanisms to move the limbs. The vertebrate animals at the very beginning of their terrestrial career evolved in two directions. One group improved the simple glands inherited from fish ancestors, threw away the fish scales and used the moist skin for respiration to a large extent. Air was gulped into the lungs at various intervals but very little pulmonary respiration was required. Consequently the ribs became reduced in some Carboniferous *Amphibia*. This skin breathing group was never able to penetrate very dry lands because they always had to keep their skins moist. They have come down to us to-day as the frogs and salamanders.

The second group of early land vertebrates presumably early gave up the glands in their skin, for during Carboniferous times these had long ribs and apparently depended entirely on their lungs for respiration. The dry skin with or without the bony plates permitted the group to occupy a much greater range of habitat than the other group enjoyed. Further they apparently early learned the trick of secreting a calcareous shell about their eggs which permitted their being laid on land without danger of desiccation. The embryo enclosed within the egg developed a new respiratory organ, the allantois, an extension of the urinary bladder of the embryo, and relied for food upon the large amount of yolk with which it, as many of its ancestors, had been endowed. This group, the *Reptilia*, nevertheless, lived at a disadvantage. Such important functions as digestion and nerve conduction, being essentially chemical processes, vary with the temperature and the body temperature of the early vertebrates followed that of the environment.

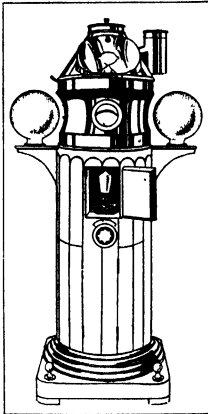
Two groups of *Reptilia* evolved in different directions to secure freedom from their environment by maintaining a constant body temperature. One group, which gave rise to the birds, modified certain scales to form a protective cover of feathers, the other group which gave rise to the mammals apparently modified a rich growth of hair-like sense organs into a coat of fur. Warm-bloodedness is not only a matter of body covering, it is essentially a consequence of the rapid oxidation of the foods within the body. Nervous mechanisms within the brain evolved to regulate these oxidation processes. The increased demand for oxygen in warm blooded animals necessitated the improvements in the heart described above. Increased speed of movement in turn brought with it improvement in the sense organs especially in the mechanisms for rapid focusing of the eyes. But rapid movement might induce overheating. To counteract this the birds developed long sac-like extensions of the lungs which carried cooling air to various parts of their bodies. The mammals developed an elaborate system of sweat glands which have very little in common with the piscine glands discarded by their reptilian ancestors. In many mammals these glands took over the additional function of excreting some of the waste substances from the body.

Lastly, comparative anatomy may encroach closely upon the field of embryology to secure evidence of homology, that is, common origin in phylogeny. The integument for example of all animals is formed of an outer covering, the epidermis, derived from the outer layer of the early embryo or gastrula. Beneath this in many animals is a more fibrous layer, the corium, formed from mesenchyme, a product of the mesoderm or middle layer of the gastrula. The epidermis secretes a flexible cuticle in many invertebrates such as annelids, rotifers and hydroids or a much denser covering of chitin in the arthropods. The epidermis may also secrete a calcareous covering as in corals and mollusks. A thin cuticle occurs in fish and in salamander larva but adult *Amphibia* and all higher vertebrates resist the drying action of the air by an increase in the number of cell layers in the epidermis and by a cornification of the superficial layers. The cornification is much less in skin breathing *Amphibia* than in higher vertebrates. The scales and claws of reptiles, the feathers of birds and the hair of mammals consist chiefly of local modifications of the horny layer. In striking contrast the corium, which forms an exoskeleton of spicules or plates in some invertebrates, produces a support of bone or dentine in the vertebrates. The scales of fish, the bony shell of turtles, the armature of the armadillo are derived from the corium. Where the epidermis comes in contact with dentine it may produce a covering of enamel as in the case of teeth. Where it overlies bone it may produce sheets of horn as in the case of the turtle shell. The epidermis also gives rise to glands and sense organs in the various phyla. It is therefore the mother of many tissues. Organs which come from certain tissues during

ontogeny have frequently done the same during phylogeny. Consequently comparative anatomy and embryology often support one another in the elucidation of the origin of structures. G. K. N.

COMPARATOR, a device for comparing parts in process of manufacture with standards that have been previously set. The name is usually applied to devices which use either projected or reflected light, or apply optical means in some form. In some devices a greatly enlarged shadow of the part being inspected is thrown against a screen carrying a correct outline. The two outlines of the part are then compared, hence the name.

COMPASS, a term given either to a drawing instrument consisting of two legs joined at the top for dividing and drawing circles; or to a freely suspended horizontal needle indicating the magnetic meridian which is used in Navigation. The needle does not point toward the geographical north, but diverges to the east or west of it to a magnetic pole, hence the term "variation of the compass." A plane through



COURTESY KELVIN AND WILFRED O. WHITE CO.

STANDARD MAGNETIC COMPASS

the magnetic pole and the center of the earth is known as the "magnetic meridian." There are two general types of compasses, viz, the liquid and the dry, the latter being largely used on vessels. See also AIRCRAFT INSTRUMENTS. Needles direct a card, marked as shown in the attached figure, the entire compass being mounted for marine use, on a pedestal or binnacle. The expression "boxing the compass" is naming the points on the card in the correct order. North is often indicated on the card by an arrow or a fleur de lis. Besides the variation mentioned above, correction must also be made for the magnetism of the ship; this error is known as "deviation." Deviation may be compensated for by soft iron balls, or bars (called Flinders bar) or by permanent magnets placed near the compass. In addition to variation and deviation, a mechanical error arises when a ship rolls. It has been found that the difficulties just outlined can be overcome by combining a compass with a gyroscope, hence the gyro-compass, for with this true north is indicated, and all readings are made directly without any computation. See also LUBBER'S LINE.

BIBLIOGRAPHY.—*Terrestrial Magnetism*, Carnegie Institution, Washington, D. C.; *Gyro-Compass*, Sperry Gyroscope Co.

COMPASS AERIAL. See AERIAL COMPASS.

COMPASS PLANT (*Silphium laciniatum*), called also pilot-weed and rosin-weed, a rough perennial of the composite family, native to the interior prairie

region of the United States. The tall, exceedingly resinous stem, surrounded at the base by large much divided root leaves, bears numerous small stem leaves and heads of yellow flowers. When growing in unshaded exposed places many of the basal leaves stand vertically upright, with their edges pointing approximately north and south. By this manner of growth the two surfaces of the leaves, which are alike in structure and equally sensitive to light, secure equal illumination. At the same time they avoid exposure to the intense heat of the noonday sun. The stem leaves of the prickly lettuce (*Lactuca Scariola*), widespread as weed, behave in a similar manner.



P. A. RYDBERG, "FLORA OF PRAIRIES AND PLAINS"

COMPASS PLANT

COMPAYRE, JULES GABRIEL (1843-1913), French educator, was born at Albi, France, Jan. 2, 1843. The earlier part of his life was spent in teaching and promoting public education. In 1890 he was made rector of the Academy of Poitiers and in 1895 of the Academy of Lyons. Among his writings which have been used extensively by American educators are *Psychology Applied to Education*, *A History of Pedagogy*, and his several books on pioneers in education. He died at Paris, Mar. 23, 1913.

COMPENSATION INSURANCE. See WORKMEN'S COMPENSATION.

COMPETITION. See ANTITRUST LEGISLATION; CLASSICAL SCHOOL OF ECONOMICS; UNFAIR COMPETITION.

COMPIÈGNE, a town and summer resort in northern France, situated on the Oise River beside the beautiful forest of Compiègne, in the department of Oise, about 50 mi. northeast of Paris. Jeanne d'Arc was here wounded and taken captive by the English, May 24, 1430. In the château, built chiefly under Louis XV, several kings resided; the château is now a museum. During the World War the Germans occupied, relinquished, and bombarded the town. It was French military headquarters in 1917-18. On Nov. 11, 1918, the Armistice was signed in the railway car of General Foch in the forest 4 mi. away. The famous medieval castle of Pierrefonds is 12 mi. distant in the forest. Pop. 1931, 17,852.

COMPLEAT ANGLER, THE, a whimsical work on angling by IZAAK WALTON; published 1653 in the form of a prose pastoral, of which the chief characters are the rustic interlocutors, Piscator and Venator. The author continued to intersperse the technical portions of his quaint work with pleasant anecdotes, songs and quotations till the year of his death, 1663. Apart from the charm of its leisurely style, *The Compleat Angler* is still an excellent treatise on angling.

COMPLEMENTARY COLORS—COMPOSITE FAMILY

COMPLEMENTARY COLORS, any two colors which, upon addition, give white light. The components may be pure, that is, monochromatic, or they may be composite. Some examples of monochromatic complementary colors as given by HELMHOLTZ, with the WAVE-LENGTH expressed in ÅNGSTRÖM UNITS, are:

Red	6,562 Å.	with	Greenish blue	4,921 Å.
Yellow	5,853 "	"	Blue	4,854 "
Yellow	5,671 "	"	Dark blue	4,645 "
Greenish yellow	5,636 "	"	Violet	4,330 "

If any portions of the spectrum of white light are combined into a single composite color, then, if the remainder of the spectrum is combined in the same way, the two colors thus obtained are complementary, for, when combined, they give the original white light. The number of combinations of complementary composite colors is obviously very large.

BIBLIOGRAPHY.—L. B. Spinney, *Textbook of Physics*, 1925.

COMPLEX, a psychological term representing repressed emotional states. Because the individual is not aware of these repressed states they are apt to be dangerous, as disturbing elements in his personality. One of the most common manifestations of this condition is what is described as the well-known **INFERIORITY COMPLEX**.

At some time in an individual's life an unpleasant association may have occurred in connection with some particular object. This is all that is necessary to start a complex in connection with this object for that individual. A mischievous child becomes sick after having indulged his liking for peaches in the absence of his mother. For years afterward he cannot see a peach without becoming nauseated. He has developed a complex at this point.

But many complexes are much more subtle than the case just cited. A man has made a fortune by stooping to questionable methods. In order to preserve his own ego respect he prefers not to think about the methods he has used. Later in life he experiences very strong emotions of resentment whenever the subject of business methods is mentioned. This is because he has developed a complex on the subject in order to protect himself. If he were honest enough to face this and could succeed in rationalizing his own conflict, the complex might disappear.

Complexes vary in seriousness from some petty trifle to a dangerous recurring emotional upset. In its extreme form a complex may become a phobia.

COMPLEX NUMBERS. Certain algebraic equations are not satisfied by roots represented by real numbers, such as 1, -5 , $2\frac{1}{2}$, and $\frac{1}{4}$. This leads to an extension of the primary number system. Thus, the equation $x^2 + a^2 = 0$ results in $x = \pm a\sqrt{-1} = \pm ai$, where i represents $\sqrt{-1}$ and is called an imaginary number; that is, $i^2 = \sqrt{-1} \cdot \sqrt{-1} = -1$. If i is multiplied by any real number, the result is an imaginary number. Imaginary numbers as defined here obey the laws of ALGEBRA. A complex number is of

the form $x + iy$ where x is the real part, and iy is the imaginary part of the complex number. The expression $\sqrt{x^2 + y^2} = r$ is the modulus of the complex

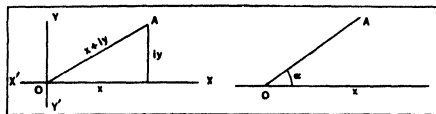


FIG. 1

FIG. 2

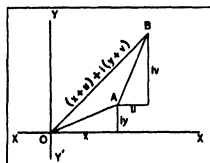
GRAPHICAL REPRESENTATION OF COMPLEX NUMBERS

number $x + iy$. Complex numbers are graphically represented on a plane OXY (Fig. 1) by taking OX as the line of the real numbers and OY as the line of the imaginary numbers, OP representing the complex number. This method of representation was proposed by Caspar Wessel, a Norwegian surveyor, in 1797. Another variation of this representation (Fig. 2) is often used. In this case the complex number is determined by the distance measured on the line of real numbers OX and the angle (α) of rotation counterclockwise of that distance in the plane of imaginary numbers. This angle of rotation is called the amplitude of the complex number. We may therefore write $x + iy$ as (x, α) . When adding or subtracting two or more complex numbers (Fig. 3), the real parts are added or subtracted separately, and the imaginary parts separately; that is,

$$(x \pm iy) \pm (u \pm iv) = (x \pm u) \pm i(\pm y \pm v),$$

where OB represents the sum of two complex numbers.

In Fig. 3 the line OA is a VECTOR, and the operations with vectors are similar to those with complex numbers. The character of the complex number depends on the direction given by the amplitude. Two complex numbers of the form $x + iy$ and $x - iy$ are conjugate, their sum being a real number, $2x$. See **TRIGONOMETRY; FUNCTIONS; DE MOIVRE'S FORMULA; IMAGINARY NUMBERS; NUMBER.** A. B.

FIG. 3
ADDITION OF COMPLEX
NUMBERS

COMPOSITE FAMILY, in botany, a group of about 14,000 species of plants, usually classified in the single family *Compositae*, but by some botanists segregated into three families, *Carduaceae*, *Cichoriaceae* and *Ambrosiaceae*. The individual flowers are relatively small and closely aggregated in heads subtended by a calyx-like involucre, each head thus simulating a single flower. The inferior ovary ripens into an achene, usually surmounted by a pappus of scales or hairs, familiarly illustrated by the fruits of dandelion or thistle. The gamopetalous corolla is tubular, or strap-shaped (ligulate), or in one exotic tribe two-lipped (bilabiate). In the thistle all flowers of a head are tubular; in the dandelion all are ligulate; in the daisy the central

flowers are tubular and the marginal (ray-flowers) ligulate, while in the ragweed the corollas are greatly reduced or absent. Composites are worldwide in distribution and everywhere abundantly developed. Those of temperate climates are chiefly herbs but shrubs and trees occur in the tropics. Economic plants of the family are few and include guayule, sunflower, chicory, lettuce, endive and artichoke. Familiar garden flowers are chrysanthemum, cosmos, dahlia, marigold, zinnia, and China aster. Among the numerous wild flowers and weeds are bonaset, aster, goldenrod, black-eyed Susan, burdock, fleabane, wormwood, and hawkweed. H. A. G.

COMPOSITE ORDER, in architecture, the last and most complex of the five orders, or codified arrangements of columns and the entablatures they support. See **ORDER**.

COMPOSITION, in graphic art, the arrangement of the elements which the artist elects to depict. A good composition has unity, variety and rhythm. The elements of the subject are blended together to give a harmonious single impression.

When primitive man began to decorate his weapons and utensils he learned that the symbols he wished to depict must be limited to the shape of the surface he had chosen to decorate. This limitation demanded choice of one subject and scaling of the object to fit the given surface. As pictorial art developed and became more complicated certain laws were evolved to produce a harmonious single impression in a pictorial representation that had more than one subject or element. The principal laws of composition are unity, contrast, balance, polarity and radiation.

To produce unity it is necessary to focalize the interest on a central point in the canvas; this point is sometimes called the climax. The climax must be the most important motive and must have the most important position. In pictorial art the climax or center of interest must be within the central area of the frame at any point where the eye will easily reach it at a single glance, and must not be too near the frame or edge of the composition.

In order to intensify the important motive there must be contrasting elements so placed that the secondary focal points are related to and help build up the climax. To achieve this the elements must be balanced; mass or weight of interest must be so disposed that there is no sense of strain. There must also be a balancing of light and shade, vertical and horizontal lines, and colors with their complements; this is the law of polarity.

All natural objects are subject to the law of "rhythmic change" which is exemplified in the spiral vortex; circles made by a stone dropped in water best illustrates this law. The space between the elements increases or diminishes as the elements increase or diminish in size. This arrangement and simple radiation from a central point, like a starfish or snow crystal, add rhythm in composition.

Two lines are said to compose when the first leads into the second and continues, or when the first is

perpendicular to the second; in the latter case they also contrast. To achieve a fine composition the great masters made use of the law of optics which is that all straight lines having a common direction appear to meet in a point sufficiently prolonged. The *Last Supper* of LEONARDO DA VINCI is a striking example of the laws of composition. The lines of the room come to a focal point in the head of the Christ which is the climax or element of greatest importance. The disciples are secondary focal points that serve to emphasize the central figure, and by contrast give variety. The horizontal lines of the table are balanced by the vertical lines of the figures and the center of interest is focalized in an equilateral triangle, the head of the Christ being the apex of this triangle.

The Oriental artist is concerned with the representation of ideas rather than things and therefore to give full play to the imagination of the beholder there is much emphasis on unfilled spaces in Eastern composition. In Oriental drawings the law of polarity, called *In* and *Yo*, meaning the active and passive, or light and shade elements, is of first importance. The shape of objects must tell whether they are seen near or far, in rain or in snow, because there is no lineal perspective. The first consideration in Oriental pictures is "space and shape, then distribution of light and shade, then placing of objects in composition to secure harmony and contrasts."

BIBLIOGRAPHY.—J. H. Van Pelt, *Essentials of Composition*, 1913; Claude Bragdon, *The Beautiful Necessity*, 1922.

COMPOSITION IN TYPESETTING. See **TYPESETTING**.

COMPOUND, a chemical combination of two or more elements, of definite composition and definite internal structure. Thus carbon dioxide is a compound of carbon and oxygen, as is carbon monoxide. Dimethyl ether, CH_3OCH_3 , and ethanol, or grain alcohol, while they are composed of carbon, hydrogen, and oxygen in the same proportions, are distinct compounds by virtue of their different internal structures. Homogeneity and constancy of composition are characteristics, but not criteria, of chemical compounds.

O. R.

COMPOUND WORD, a word composed of two or more **BASES**, each with or without **DETERMINANTS**, of which only the last member receives **INFLECTION**. Compounds fall into five chief categories: copulative, determinative (dependent, descriptive, appositional), possessive, iterative and objective. Copulative compounds, rare except in **SANSKRIT**, simply add the members together, as Latin *reci-procus*, "backward and forward," colloquial French *Monsieur-Madame*; in the dependent, the first member stands in a case-relation to the second, Latin *nomen-clator*, "name-caller," English *man-made*; in the descriptive, the first member qualifies the second, as Greek *akro-polis*, "high-town," English *blue-berry*; in the appositional, the one member equals the other, as Greek *iatro-mantis* "physician-seer," English *man-servant*; the possessive normally results from the adjectivization of the second member, as Latin *capri-cornus* "goat-horned,"

English *big-hearted*; the iterative is a mere repetition for the sake of emphasis, as Latin *quis-quis*, "anybody"; and the objective, of somewhat obscure formation, has as its first element a verbal element of which the second is the object, as Sanskrit *vidād-vasu*, "grant-wealth," Greek *philo-theos*, "love-God," Latin *verti-cordia*, "turn-heart," English *cut-throat*.

The members of a compound need not be in juxtaposition, e.g., Latin *ob vos sacro*, "I beseech you" beside *obsecro vos*; German *ich setze es zusammen* beside *ich habe es zusammengesetzt*, English to *uswards* beside *towards us*. The test here is purely psychological; has the compound acquired a special meaning in the speaker's mind? Thus *blackberry* is a compound with a special meaning, so that one says with no sense of incongruity that a "green blackberry is red." A further test lies in the accentuation, a compound, like any other word, having only one primary ACCENT, as *blackberry* contrasted with *black berry*.

Compounds in which both members are inflected, as Latin *juris-jurandi*, "of an oath," German *landes-verrat*, "treason," English *Queens-town* are termed "pseudo-compounds." In SEMITIC the compound seems to be represented by combining the construct case with another noun, the construct having no accent of its own, so that Hebrew *bêṭ ham-melek* seems to have meant originally not "the king's house," but "the king-house." L. H. G.

COMPRESSED AIR is used at pressures varying from a few ounces to thousands of pounds. It is used in many arts and industries, from dentistry to blast furnaces, being most commonly employed in the pneumatic riveting hammer (see PNEUMATIC TOOLS), the SAND BLAST, the automobile tire, and the Air Brake. In these and other cases the air is compressed by some sort of AIR COMPRESSOR and is usually stored in a reservoir large enough to maintain a constant pressure at the point of application.

COMPRESSIBILITY, COEFFICIENT OF. See ELASTICITY.

COMPRESSION, all substances are composed of ATOMS so arranged that there is a great deal of space between them. Even the atom itself is thought of as a small solar system of which the greater part is free space. As a result of this emptiness, matter can be compressed by the application of force. The supporting columns in a tall skyscraper are very perceptibly compressed by the load which they carry. A study of the compressibility of the elements has been made, and it has been found that their respective compressibilities follow very closely many of their other atomic characteristics.

The laboratories of physics and chemistry at Harvard University have been leaders in the studies of the effects of pressure on the elements. P. W. Bridgman developed methods for producing very high hydrostatic pressures, with which F. Richards investigated the compressibilities of the elements. See also AIR COMPRESSORS.

COMPROMISE OF 1850, a group of acts of Congress intended to establish a permanent adjust-

ment between northern and southern interests, and thus minimize the slavery question in politics. Senator HENRY CLAY, Jan. 29, 1850, presented the basis of the Compromise, mutual concessions to satisfy the conservative elements North and South. His moderate colleagues, Webster, Cass, Douglas and others, united with him against the southern extremists, led by Jefferson Davis, and the northern extremists, led by Seward and Chase, to secure the passage of five bills: California was admitted to the Union as a free state; Utah and New Mexico were organized as territories without prohibition of slavery, under the doctrine that Congress should not interfere with the wishes of the inhabitants; Texas was denied its claim to the Rio Grande from mouth to source as its western boundary, and given \$10,000,000 in compensation; the slave trade was abolished in the District of Columbia, and a severe FUGITIVE SLAVE LAW was enacted. The Compromise may conceivably have postponed the Civil War a few years, but was ineffective in its hopes of allaying the slavery controversy. Webster and other statesmen who supported the Compromise were denounced by the extremists of their constituencies.

COMPTON, ARTHUR HOLLY (1892-), American physicist, was born at Wooster, Ohio, Sept. 10, 1892. He obtained his doctorate at Princeton in 1916. After teaching at the University of Minnesota and conducting researches for the Westinghouse Lamp Co. of East Pittsburgh, Pa., he went to Cambridge, England, in 1919. He returned to the United States in 1920 to become head of the department of physics at Washington University, St. Louis, Mo., and in 1923 was appointed professor of physics at the University of Chicago. In 1915 he devised a simple laboratory method of showing the rotation of the earth, but his name is associated principally with researches in the field of hard gamma rays, whose wave-length Compton was the first to measure. The change of wave-length occurring in scattered X-rays was discovered by him and is known as the COMPTON EFFECT. His published scientific works include *X-rays and Electrons*, published in 1926. In 1927 he was awarded the Nobel Prize in physics.

COMPTON, KARL TAYLOR (1887-), American physicist, was born in Wooster, O., Sept. 14, 1884. He graduated from the College of Wooster, 1908, and took his Ph.D. at Princeton University, 1912. After teaching at Wooster and at Reed College, he joined the physics staff at Princeton in 1913, and became chairman of the department in 1929. The following year he was elected president of the Massachusetts Institute of Technology. He is consulting physicist for the United States Department of Agriculture and for the General Electric Company.

COMPTON, a city in Los Angeles Co., southern California, situated midway between Los Angeles and Long Beach, and the great Los Angeles and Long Beach Harbor, 10 mi. from each. The Southern Pacific Railroad and Pacific Electric Railway and motor

trucks afford transportation. There are two airports. Highly productive oil fields, storage plants and refineries make up the chief industries of the region. The principal local manufacture is oil well tools. Sugar beets and vegetables, especially cauliflower, are the main crops of the vicinity. The retail trade of the rapidly growing city in 1929 amounted to \$5,579,637. Compton is the seat of the Oil Equipment and Engineering Exposition, with a building for permanent displays. Founded in 1865 Compton was incorporated in 1888. Pop. 1920, 1,478; 1930, 12,516.

COMPTON EFFECT. In 1923, A. H. COMPTON showed that the WAVE-LENGTH of X-RAYS, after collision of the rays with free ELECTRONS, is greater than before the encounter. The importance of this lies primarily in the proof which it gives of the corpuscular nature of X-rays.

This change in the wave-length of scattered X-rays, known as the Compton Effect, is very small and is calculated from the equation

$$\lambda = \lambda_i + \frac{h}{mc} (1 - \cos \theta)$$

which states that the wave-length, λ , of the scattered beam is greater than that, λ_i , of the incident beam by an amount, $\frac{h}{mc} (1 - \cos \theta)$. Here h , m and c are constants, i.e., Planck's constant (see PLANCK'S LAW), the mass of the electron and the VELOCITY OF LIGHT, respectively, so that $\frac{h}{mc} = 2.42 \times 10^{-10}$ cm.

The increase in the length of the ray is therefore dependent only on the angle, θ , between the incident and the scattered beam. The greater the angle, the greater will be the modification. For an incident X-ray beam whose wave-length is 0.0000000558 cm., the increase at 46° C. will be 0.0000000007 cm. or 1.3%.

The Compton formula given above has been carefully tested by means of X-ray spectrometers (see SPECTROSCOPE) for this increase of wave-length, and, by means of the Wilson expansion chamber, for the direction of recoil of the electron and the scattered X-ray. It has been found to be true, thus offering great support for the QUANTUM THEORY from which it was derived. The basis of this theory is that radiant energy, such as X-rays, consists of corpuscles or particles, called quanta, or photons, whose size varies with the wave-length of the ray. A ray of shorter wave length has a greater amount of energy in its photons than one of longer wave-length. The Compton picture is, therefore, one of a collision of a photon with an electron, like a collision between two billiard balls. Part of the energy in the photon is given to the electron to cause its recoil, leaving less energy in the photon. This, according to the quantum theory, means an increase in the wave-length of the X-ray. J. B. H.

BIBLIOGRAPHY.—A. H. Compton, *X-rays and Electrons*, 1926; E. N. da C. Andrade, *The Structure of the Atom*, 1927.

COMPTROLLER, or CONTROLLER, the company, municipal, or institutional executive in charge

of the accounting records. The term, in business practice, is not well defined, some executives performing the comptrollership function are not so called, while others, doing much less than a real comptroller's duties, yet bear the title. In the functional organization of business, the comptrollership is coordinate with the functions of procurement, marketing, personnel and finance, the executive in charge of each being directly responsible to the head executive officer, usually the president, although in some cases the comptroller reports directly to the board of directors. In a large organization, the comptroller's office is usually organized into systems and procedures; record making or bookkeeping; auditing; standards and measures; reports and statistics. In municipal corporations the specific duties of the comptroller are usually set forth in the charter or prescribed by law.

COMPTROLLER OF CURRENCY. See NATIONAL BANK ACT.

COMPURGATION, among the early Germans was one of the means of legal defense, in the absence of evidence. The defendant took oath, i.e., called God to witness as to his innocence, and a certain number of companions, compurgators, originally his kinsmen representing clan solidarity, took oath with him. These were not witnesses, but they could be used to refute witnesses. The number required varied according to the offence and the social standing of the parties. If by resort to other forms of proof, like the ordeal, their man received an adverse judgment the compurgators were guilty of perjury.

COMPUTING MACHINE. See CALCULATING MACHINE.

COMSTOCK, ADA LOUISE (1876-), American educator, was born at Moorhead, Minn., Dec. 11, 1876. She graduated from Smith College in 1897 and from Columbia University (M.A.) in 1899. After serving as instructor and professor at the University of Minnesota for several years, she was made the first dean of women. In 1912 she became the first dean of Smith College, leaving in 1923 to become the first full-time president of Radcliffe. Miss Comstock has been active in national problems as well as educational work. She was the only woman appointed by President Hoover to serve on the National Law Enforcement Commission in 1929.

COMSTOCK, ANNA BOTSFORD (1854-1930), American naturalist and wood engraver, was born at Otto, N.Y., Sept. 1, 1854. She graduated from Cornell University in 1878 and studied art at Cooper Union. The same year she married JOHN HENRY COMSTOCK, distinguished entomologist. She was assistant professor at Cornell in extension work in nature study in 1899, lecturer in extension work at Stanford 1899-1900 and successively assistant professor and professor of nature study at Cornell 1913-22. Mrs. Comstock attained great reputation as a naturalist and wood engraver, and exhibited at the Chicago Exposition, 1893; Paris Exposition, 1900, and Buffalo Exposition, 1901. In 1923 she was named one of the 12 greatest living American women by the National

League of Women Voters. She died at Ithaca, N.Y., Aug. 24, 1930.

COMSTOCK, ANTHONY (1844-1915), American reformer, was born in New Canaan, Conn., Mar. 7, 1844. After serving in the Civil War he came to New York and worked as a clerk and salesman, but his acute moral conscience and abnormal sense of sin compelled him to enter reform work, and in 1873 he became for life the secretary of the New York Society for the Suppression of Vice. In this position combined with post office inspector he waged war upon books and pictures which he considered obscene. His influence in Congress was considerable. He effected the passage of the law barring birth control information from the mails and was instrumental in passing the Mann Act. He died in New York City Sept. 21, 1915.

COMSTOCK, JOHN HENRY (1849-1931), American entomologist, was born in Janesville, Wis., Feb. 24, 1849. Graduating from Cornell University in 1874 he continued his studies at Yale from 1874 to 1875 and at Leipzig from 1888 to 1889. He taught at Cornell from 1875 to 1878 and from 1879 to 1881 was United States entomologist. In 1881 he became professor of entomology at Cornell and professor emeritus in 1914. Holding a high rank as a teacher, he wrote a number of works upon entomology, including *Insect Life and Introduction to Entomology*. He died at Ithaca, N.Y., March, 1931.

COMTE, AUGUSTE (1798-1857), French positivist philosopher, was born Jan. 19, 1798, at Montpellier. He was student, tutor and examiner at the École Polytechnique. Meeting Saint-Simon in 1818 he was inspired by the work of this visionary and became his close friend until he broke their relationship in 1824. Comte began a course of lectures in 1826; but his health failed and he attempted suicide by throwing himself into the Seine. From 1830-42 Comte was engaged in producing his monumental work, the *Course of Positive Philosophy*. Here he developed the famous law of the three stages and worked out a scheme for the classification of sciences according to their degree of positivity. Comte's later years were spent in propagating his religion of humanity which he had worked out in his *Positive Polity*, 1852-54. He is often given credit for having founded the science of sociology; but in the works of Saint-Simon may be found in germ most of the ideas which Comte later developed. He hoped that society might be able to control itself but apparently had little willingness to give it freedom to do so. His religion of humanity was characterized by the minuteness of detail to which it was worked out. Here Comte was never able to get away from his Catholic training. He died in Paris, Sept. 5, 1857. See **POSITIVISM**.

COMUS, in mythology, the god of mirth. He is pictured as a youth with wings, asleep and crowned with flowers, holding in one hand a spear and in the other a torch. Sometimes he is attendant on Dionysus. (See **BACCHUS**.) Milton, in his poem *Comus*,

described him as having the power to change human faces into those of beasts. This, however, has no foundation in classical mythology.

CONATION, a term for the volitional aspect of consciousness. From the standpoint of structural psychology conation is one of the main elements of experience, these elements being the affective and cognitive as well as the conative. As affection and cognition were analyzed into their elements of pleasure and pain on the one hand and sensation on the other, so conation was analyzed into its elements. These consisted of the simple impulses which combined to produce desires and more complex volitional processes. The term "affective-motor" processes is now used to describe the phenomena of affection and conation.

CONCEALMENT, in law, a term applying to the concealment of the birth and death of infants. It is regulated by **STATUTES** which vary in different states. The original statute was enacted in England in 1624, but has been subsequently greatly modified. In the United States nearly every state makes concealment a **FELONY**, but differ both as to what constitutes concealment and how it is to be punished.

CONCENTRATE, in ore treatment, valuable ore which has been mechanically separated from the **GANGUE**, or worthless minerals, with which it was mined. The waste material of concentration is called **TAILINGS**. The purpose of concentration is to reduce the ore to a small bulk to effect economy in further treatment. The properties which permit mechanical separation are specific gravity (**GRAVITY CONCENTRATION**), adhesion (**FLOTATION PROCESS**), magnetic permeability and electric conductivity. See **ORE TREATMENT**; **ELECTROSTATIC SEPARATOR**; **MAGNETIC CONCENTRATION**.

CONCENTRATED FEEDS. See **FEEDS, CONCENTRATED**.

CONCENTRATION CAMP, a camp in which troops of an area such as a corps or army area are concentrated for organization and training. Concentration camps in the zone of the interior represent the final step in **MOBILIZATION**. In the theater of operations they are established as a stage in the preparation for imminent hostilities.

CONCEPCIÓN, a city of central Chile, capital of the province of the same name, situated on the Biobío River about 355 mi. southwest of Santiago. It has good railroad connections and a brisk trade through the ports of **TALCAHUANO**, 8 mi. distant, and **Penco**. The center of the city is the Plaza de la Independencia. Among its buildings is a university, a cathedral and a bishop's palace. The chief industries are the manufacture of furniture and liquors, and there are flour mills. The products of the surrounding district are wheat, grapes, wool, cattle and timber. Pop. 1930, 77,589.

CONCEPT, a term used to designate a general idea. Psychologically the concept is derived from the observation of a number of particular instances. It grows along with the examination of particular things embodied in the class it represents. At first the word

dog may be nothing but a verbal sound to an infant. As the word is identified with the family dog it may then be extended to include other animals of this sort. Dogs outside the family thus become known as dogs and are responded to as such. Many concepts are built up on the basis of vicarious experience; it is possible, for example, to have a concept of the Sahara Desert even though one has never been there. Nevertheless the concept would be greatly enriched by a trip to this region. The concept is used to interpret the particulars of this experience. When concepts are not adequate the meaning is confused. A concept is a working tool that has been built up by the process of abstraction.

CONCEPTION, the union of the male and female elements of procreation, whereby a new individual results. Synonyms for this word are fecundation, fertilization and impregnation. The male unit of procreation is the spermatozoon, an extremely small cell, millions of which are found in the testicles. The female unit is the ovum, a large cell and this comes from the ovaries. One ovum is expelled from one of the two ovaries each month, approximately half way between two menstrual periods. A few hours after expulsion, the ovum may be found in one of the two fallopian tubes, which are extensions of the womb. There the ovum awaits one of the millions of spermatozoa which were deposited in the vagina during the act of sexual intercourse. If no spermatozoon is forthcoming, after a few hours the ovum dies. A number of days later, MENSTRUATION takes place. An ovum is capable of uniting with a spermatozoon for only a few hours, but a spermatozoon may be capable of fertilization for a number of days. If a spermatozoon unites with an ovum in the fallopian tube, the united elements grow rapidly and pass down the tube into the cavity of the womb. There the structure which results from the union burrows under the lining of the womb and continues to grow in normal cases until a full term child is developed.

It is important to prevent conception in such serious illnesses as kidney disease, severe heart trouble, advanced tuberculosis and others. The conservative measures chiefly used for this purpose are mechanical or chemical in nature. Conception can also be avoided by operation or by means of the Roentgen rays and radium.

J. P. G.

CONCEPTUALISM, the intermediate position in the scholastic controversy between realism on the one hand and nominalism on the other. It was championed by the brilliant schoolman PIERRE ABELARD (1079-1142), with whom the doctrine is usually identified. Fundamentally, however, it is the old position of ARISTOTLE, and Abeldard is to ANSELM and ROSCILLINUS what Aristotle was to PLATO and DEMOCRITUS.

Conceptualism holds that neither the universal nor the particular is real as such, but that the universal exists in the things which are understood by them. Table and chair as concepts are not real; neither is a particular table nor a particular chair a reality. What is real is the union of universal and particular in the

concrete objects. The scholastic phrasing of the conceptualistic position is *universalis in re*, or that the universal exists in the thing.

CONCERTO, a musical composition having the formal structure of a sonata but scored for a solo instrument with orchestral accompaniment. If for two solo instruments it is called a double concerto; if for three, a triple. Although two centuries and more ago the term concerto was applied to vocal compositions with organ accompaniment, which were known as *concerti ecclesiastici*, this usage has since been generally abandoned, and a concerto now signifies a work for instruments only. While it follows the outlines of a sonata, there is usually opportunity for technical display by the soloist throughout the work, while in the cadenza (a section for unaccompanied solo work in the first movement) the performer's virtuosity is accorded full license. Under Corelli (1653-1713), Vivaldi (c. 1675-1743), J. S. Bach (1685-1750), and Handel (1685-1759), the *concerto grosso* for two or more accompanied solo instruments paved the way for the more formal concerto of Mozart (1756-91), who gave finality to its structural pattern. The later developments under Beethoven (1770-1827) and Brahms (1833-97) were chiefly in emotional profundity and in an elaboration of the orchestral accompaniment which frequently attained symphonic importance.

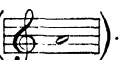
CONCERT OF EUROPE, THE, a vague concept, devoid of juridical meaning and lacking institutional form, used by European diplomacy during the 19th and the early 20th centuries to secure united action in times of international crisis. Theoretically, it represented the concerted determination of all the sovereign states to uphold the so-called public law of Europe. Actually, it was an instrument of policy of the dominant Powers. Thus, its most concrete manifestations were the Quadruple Alliance of 1814, directed against Napoleon as a "disturber of the peace," and, following his defeat, the interventionist policy of Metternich against revolution.

The Concert of Europe also functioned more or less effectively in dealing with disputes among lesser states, which did not vitally affect the interests of the Great Powers. On such occasions the Great Powers, being relatively disinterested and anxious to avert inopportune complications, were able to resort to concerted action in order to coerce the disputants into preserving the peace or, failing that, to localize the conflict and to impose a compromise settlement. In this capacity of preserver of the general peace in times of local conflicts, the Concert came nearest to becoming institutionalized in the London Conference of Ambassadors, 1912-13, which, under the presidency of Sir Edward Grey, mediated between the victorious Balkan allies and Turkey, created an independent Albania and localized the first Balkan War, though it failed to avert the second.

CONCERT OF POWERS, in general, the collective action of the leading powers, sometimes including smaller states, in dealing with some specific problem of international interest, or with some crisis in inter-

national affairs. Examples are the Congress of Berlin of 1878 to consider the problem of the Near East, the Algeciras Conference of 1906 to settle the status of Morocco and the joint armed intervention of the Powers in China in 1899 to suppress the Boxer revolt.

CONCERT PITCH, in music, refers to musical pitch arbitrarily established by musicians in opposition to philosophical or **ABSOLUTE PITCH** which is based on logical considerations. It has varied throughout the centuries and in different countries. As the speed of air waves increases approximately two feet per second for every degree of increase in temperature, the temperature is usually included when the pitch is stated; not entirely a consistent policy since the humidity is an even more important factor and hygrometric data are neglected. The following pitches are the number of double vibrations per second producing a'

().

Handel's tuning fork	422.5
1625-1825	420 (average)
French Pitch	
(International)	435 (59° F.)
Stuttgart Pitch	440
American Federation of Musicians	440 (68° F.)

CONCESSIONS, politically, a term long used to cover many types of franchise, charter and privilege, but in the modern international sense the word indicates a grant under contract or treaty, by a state or some agency of a state, to another state or to its nationals, for exploiting natural resources such as minerals or oil, building and operating public services, such as railroads, or for administering territory. Such territorial concessions were granted to several European nations by China, particularly between 1898 and 1902. The United States has received concessions, particularly for naval purposes, from several American states. Rivalry to obtain valuable concessions distinguished international competition in the period preceding the World War.

D. P. B.

CONCH, the popular name for the shells of many large sea snails or shell-bearing marine gastropods. Strictly it belongs to those of the carnivorous strombs, some of which are of considerable economic value. Shells of the big rose-lined stromb (*Strombus gigas*), which is found on the coasts of Florida, the Bahama Islands and the West Indies, are shipped in large quantities to the United States and England every year. Cameos are cut from these shells and they are used to make buttons, porcelain and lime. In the South, particularly in colonial days, they were often made into dinner horns. Beautiful pink conch pearls are occasionally found in these shells.

Around New England, Long Island and New Jersey the name conch is given to the shells of two big sea snails (*Fulgur carica* and *Sycotypus canaliculatus*) common in the vicinity. Both are carnivorous and are very harmful to the oyster beds. The oyster-

men also call them wrinkles. The Indians made white wampum from the column of their shells.

CONCIERGE, THE, a prison of Paris, attached to the Palais de Justice, formerly the royal palace. As a prison it is celebrated for its associations with momentous events of French history, particularly the French Revolution. Here Marie Antoinette was confined, and here Robespierre and Danton waited before passing to their death. In the Cour des Femmes have been confined Madame Elizabeth, the Noailles ladies, Charlotte Corday, Madame Roland, Cécile Renault, and Madame Dubarry. The Conciergerie is to-day the chief criminal prison of Paris.

CONCILIATION. See **ARBITRATION**.

CONCILIATION SERVICE, U.S. See **LABOR, DEPARTMENT OF**.

CONCLAVE, an ecclesiastical term signifying the assembly of cardinals at Rome to elect a pope. It is the present custom for the cardinals to meet in the Sistine Chapel at the Vatican, and during the election they are separated from all personal contact with the outer world. The election at the present day is by secret ballots and a two-thirds majority is required for a decision. After each ballot the voting papers are burned in a stove, and if the result is inconclusive, straw is mingled with them, the smoke of which from a chimney is visible outside the Vatican, where it is thus known that the ballot has failed. When a Cardinal accepts election, all other cardinals lower the canopies over their seats, so accepting the new pope's sovereignty. In 1904, Pius X abolished the right of any Catholic country to veto the election of a pope. See **HAPSBURGS**.

CONCORD, a town and village, in Middlesex Co., northeastern Massachusetts, served by the Boston and Maine Railroad. The village lies at the meeting of the Sudbury and the Assabet rivers to form the Concord, about 20 mi. northwest of Boston. There is a chair factory and a foundry. The historical and literary significance of Concord are especially interesting. It was founded in 1635. In October 1774 John Hancock acted as chairman of the first Provincial Congress of Massachusetts which met here, and resolved to resist the English government. The first fighting of the American Revolution, 1775, when the "embattled farmers" withstood the British and drove them back to Lexington, is marked with a monument, dedicated in 1837.

RALPH WALDO EMERSON, A. BRONSON ALCOTT, LOUISA M. ALCOTT, HENRY D. THOREAU and NATHANIEL HAWTHORNE lived and wrote here. "Concord grapes" were first cultivated here in the middle of the 19th century. Pop. 1920, 6,461; 1930, 7,477.

CONCORD, the capital of New Hampshire, a city situated in the southern part of the state on the Merrimack River. It is the county seat of Merrimack Co., and is 18 mi. north of Manchester. Of the various manufactures, the most important are textiles. In 1929 the manufactures reached an approximate total of \$11,000,000; the retail trade in 1929 amounted to

\$13,503,639. Concord has an airport and is served by the Boston and Maine Railroad. The capitol is built of white granite found in the vicinity. There are several other handsome public buildings and a number of state institutions located in Concord. It is the seat of St. Paul's school for boys and St. Mary's school for girls, both Protestant Episcopal institutions, and four Roman Catholic schools. Benjamin Thompson, scientist and social reformer, lived here. Three miles away is the birthplace of Mary Baker Eddy, founder of Christian Science. Her home is now a home for aged Christian Scientists.

Settlers from Massachusetts towns founded Concord in 1652. It is the scene of the famous New England Land case, which arose through a dispute between the settlers from Massachusetts and the people of New Hampshire, both claiming the grants of the other were invalid. The settlement was first called Pennycook. Later, in 1774, the Massachusetts general court incorporated it as Rumford, upholding the claims of the Massachusetts settlers, but granting jurisdiction to New Hampshire. It became the incorporated town of Concord in 1784. Pop. 1920, 22,167; 1930, 25,228.

CONCORD, a city and county seat of Cabarrus Co., in southwestern North Carolina, situated 22 mi. northeast of Charlotte. The Southern Railroad and bus lines serve the city. Cotton and corn are the chief crops of the vicinity and textiles are the principal manufactures. In 1929 the retail trade amounted approximately to \$6,610,000. Concord was incorporated in 1851. Pop. 1920, 9,903; 1930, 11,820.

CONCORD, BATTLE OF, Apr. 19, 1775, one of the chief battles of the REVOLUTIONARY WAR. Having won the first affray of the war, the BATTLE OF LEXINGTON, against numerically weak opposition, the British force under Col. Smith marched to Concord. At the Old North Bridge a small party of MINUTE MEN offered battle; after several casualties on either side, the provincials gave way. In Concord Smith found that the bulk of the arms and ammunition which he had been dispatched to seize had been removed and concealed by the inhabitants; after disabling several cannon and destroying a small quantity of supplies, the troops began the return march. Provincial volunteers, however, had been swarming to the scene. At the bridge and along the road toward Lexington the British were harassed by irregular warfare from ambush, and the march to Boston became a rout. At Lexington the exhausted troops were again beset, but were saved from probable surrender by the arrival of a reinforcement of 1,200 troops under Lord Percy. From Lexington to Charlestown the troops encountered the same running warfare. The British loss in the day's fighting was 273 men; the provincials lost about 90.

CONCORDAT, a term applied to a treaty arranged between the papal see and a secular ruler or government for the general regulation of the relations between Church and State in the country concerned. The earliest on record was the Concordat

of Worms, 1122, which brought to a close the long drawn-out investiture struggle between the papacy and the empire. Of modern Concordats, the most famous was that arranged by Napoleon in 1801, which re-established the Church in France and continued in force under successive governments until it was abrogated by the Third Republic in 1905. In the 19th century a considerable number of Concordats were drawn up with Roman Catholic countries. In general these provided, on the one hand, for the recognition of the claims of the Roman Catholic Church to a privileged position, and, on the other, provided that the government have some measure of control over Church affairs within its borders.

CONCORDAT, FRENCH, of 1801, was an agreement entered into by Bonaparte and Pope Pius VII to regulate the status of the Roman Catholic Church in France under the Consular government of which the Corsican general was the head. The French Revolution had successively dispossessed, disestablished, and endeavored to destroy the Catholic religion in France. Because the revolutionary assemblies had never been consulted nor negotiated with the Pope regarding any of the economic or political changes in the status of the Church, the Pope had decreed thoroughgoing antagonism to the Revolution on the part of all Catholics. The result was that every succeeding government in France, national or local, met with constant opposition and hindrance from a considerable part of the population. It was in order to heal permanently this breach, that Bonaparte undertook the negotiations which led to the Concordat.

The document, as brief as its preparation had been lengthy, attempted to settle every ground of difference between the nation and the Church. First and foremost, it restored the Church to a favored position in the State. Like the Concordat of 1516 arranged by Francis I during the Italian wars, the Concordat of 1801 provided that the First Consul, namely Bonaparte, should appoint the approximately 80 bishops in France and that the bishops should appoint the priests. Like the unilateral Civil Constitution of 1790, the Concordat provided that both bishops and priests should be paid by the State. But Bonaparte was careful not to accept the Catholic religion as the only one recognized by the State. To do so would have meant abrogating the religious freedom secured by the Revolution, and thus alienating a group as considerable as that of the reconciled Catholics. Likewise, Bonaparte refused to return the confiscated church property. The Pope agreed that neither he nor his successors should "ever disturb in any manner the possessors of the confiscated church lands." By the same act, the Pope recognized the French Republic, which directly strengthened the position of Bonaparte in France as a legitimate ruler. The good-will of the Catholics was his, without his being in any way a good Catholic or even a religious man. He is reported to have said that if he had a nation of Jews to govern, he would rebuild Solomon's

temple. In his Egyptian campaign, he paraded through the streets of Alexandria in the costume of the Moslem and gave it out through his excellently organized press-service that he was a Mohammedan. Although many at the time and since have felt that the agreement was a tactical mistake on Bonaparte's part, and a renunciation of the revolutionary forces that brought him to the fore, it appears on the face of it that the Concordat rallied millions to the government, and that Bonaparte gave up very little for that undoubted advantage. J. Ba.

BIBLIOGRAPHY.—*Raccolta di Concordati*, ed. by A. Mercati, 1919; A. Fournier, *Napoleon I*, trans. by A. E. Adams, 2 vols., 1912; J. O. B. Cleron d'Haussonville, *L'Eglise romaine et le premier empire, 1800-1814*, 5 vols., 1868-69.

CONCORDIA, in Roman mythology, goddess of harmony and peace. Of her many temples the best-known was in the Forum at Rome. It was twice rebuilt. Here the Senate often met, and here Cicero delivered his last oration against Catiline. Concordia is represented with an olive branch and cornucopia in her hands.

CONCORDIA, a town of Argentina, in the province of Entre Rios, situated on the Uruguay River, 150 mi. northeast of SANTA FÉ. It has oil refineries, meat packing houses and tanneries. Leather, meats and tea are the chief exports. Est. pop. 1930, 30,144.

CONCORDIA, a city in northern Kansas, the county seat of Cloud Co., on the Republican River, 155 mi. west of Atchison. The city is a railroad center, served by four lines. There are coal fields in the vicinity. Wholesale trade and flour milling afford the chief industries. Concordia was founded in 1871 and incorporated a year later. The United States Weather Bureau has a station in Concordia. Pop. 1920, 4,705; 1930, 5,792.

CONCORDIA COLLEGE, at Moorhead, Minn., a coeducational institution controlled by Concordia College Corporation, which is made up of congregations belonging to the Norwegian Lutheran Church of America. Founded as an academy in 1891, it added college courses later, graduating the first college class in 1912. Nine years later the academy was discontinued. The productive funds in 1931 were \$625,796. The library contains 20,000 volumes. In 1931-32 there were 415 students and a faculty of 35 headed by Rev. John N. Brown.

CONCRETE, in logic, a term applied to the specific and particular, the opposite of abstract. A concrete term is one which applies to a particular object or thing. "A table," "the chair" and "this book" are examples of concrete terms. These objects may all be brought into perception. Percepts are concrete. One cannot see "man" but he can see "a man." Man is a general term; "a man" is specific and particular, hence concrete.

CONCRETE, a mixture of CEMENT, water, and fine and coarse AGGREGATES. The cement is usually a standard Portland cement; the fine aggregate Sand; and the coarse aggregate, a crushed Stone or Gravel.

The hardening of a Portland cement concrete is due to a chemical reaction between the cement and the water, the rate and amount depending upon several things such as the proportion of cement and water, temperature, quality of cement, presence of impurities, thoroughness of mixing, care in placing, and care and protection when curing. The recent discovery that the relation of the weights of water and cement, i.e., the water-cement ratio, gives an accurate measure of the strength of the concrete, makes it possible to pre-determine with considerable accuracy the strength of concrete which will be obtained with any given combination of concrete materials.

Reinforced Concrete. Plain concrete has low strength in TENSION, although it has high strength in COMPRESSION. To overcome this weakness, steel is added, usually in the form of bars embedded in the concrete in quantities dependent upon the nature and magnitude of the stress to be sustained.

The concrete acts as a FIREPROOFING for the steel, enabling it to continue unimpaired in a fire, when steel not thus protected would speedily become soft and useless. It also acts as a rust protection for the steel.

Extensive laboratory experiments and load tests on completed structures have done much to advance the knowledge of the properties of re-enforced concrete. The various reinforced concrete members entering into a building can be computed accurately as to size and the amount of steel. G. A. H.

CONCRETE PRODUCTS, term used to include those units of CONCRETE which when bonded together or bonded with other materials form a part of the structure. These units include: Standard Dimension Brick; Light Weight Structural Tile; Blocks, and Cast Stone.

The unit known as "concrete brick" is usually machine made and is of the same dimension as an ordinary clay Brick. The proportion of CEMENT and AGGREGATES used in its manufacture depends upon the strength and durability required. Concrete brick have not been, as yet, extensively used.

Light weight concrete "structural tile" are thin walled hollow units of concrete, usually manufactured by power equipment. The size most commonly used is 5 in. x 8 in. x 12 in. It lays up rapidly and is equivalent in volume to about six bricks. It is used principally in walls as a backing for face brick.

"Blocks" are made in standard machines and are usually 8 in. to 12 in. thick and may be obtained in several different heights and widths. The 8 in. x 8 in. x 16 in. block is the most common size. Concrete blocks ordinarily have one or more hollow spaces making a product of small weight, sufficient strength and good insulating qualities.

"Cast stone" is made of cement combined with fine and coarse aggregates and proportioned to produce the desired texture and strength. It is formed in molds of sand or wood and its surface finish is produced in many cases by the methods used for the finishing of natural stones. G. A. H.

CONCRETE ROADS AND STREETS are made by laying on a prepared "subgrade" a CONCRETE slab that constitutes both a wearing surface and a PAVEMENT BASE in a single course. The AGGREGATE should not exceed three inches in size. Good specifications call for about twice as much coarse aggregate as sand and require six or more sacks of cement, and not more than 250 pounds of water, to the cubic yard of concrete. Expansion joints filled with asphaltic materials and contraction joints or artificial "planes of weakness," to permit movement under changes of temperature, must be provided. The slabs are reinforced with steel bars and thickened along the edges, and sometimes wire fabric is employed to reduce cracking. Pavements are finished true to grade by "screeds" or "templates," are often "tamped" by machines and are kept covered and moist for several days. Extensively used for city streets, since 1910 they constitute the greater part of the hard surfaced pavement laid on "primary" roads. *See also HIGHWAYS.* W. W. H.

CONCRETE TESTS are of two types. "Slump" and "flow" tests made on freshly-mixed concrete; and strength determinations made on cylinders and beams.

Slump Test. A frustrum of a cone, 12 inches high, four inches in top diameter and eight inches in bottom diameter, is filled in three increments with the freshly-made CONCRETE. Each increment is "rodded" 25 times with a bullet-nosed rod, $\frac{1}{4}$ inch in diameter and 24 inches in length. The cone is removed immediately and the amount the concrete slumps, measured in inches, is the slump value.

Flow Test. A frustrum of a cone, five inches high, $6\frac{1}{4}$ inches in top diameter and 10 inches in bottom diameter, is filled in two increments and each increment "rodded" as in the slump test. The cone is removed and the table top on which the concrete has been placed is raised and dropped $\frac{1}{2}$ inch 15 times in ten seconds. The average diameter of the spread concrete is measured. The "flow value" is the final diameter divided by the initial diameter and multiplied by 100.

Compression Tests are usually made on cylinders, although sometimes cubes are used. Concrete strengths indicated by cubes are slightly higher than those indicated by cylinders.

The diameter of the "standard" cylinder must be at least four times the maximum size of any particle in the aggregate, and the length twice the diameter. A mold 6 inches in diameter and 12 inches long is most commonly used, and must be made of non-absorbent materials. It is filled in three increments and each increment "rodded" as in the slump test. Both ends of the cylinder must be perfectly smooth so that the pressure will be distributed uniformly over the entire section.

After the cylinders are made they are placed in moist storage for 28 days or until tested. Tests are also made at other ages when it is desired to determine the effect of age. The University of Wisconsin

has started a series which will run for 100 years. *See also TESTING MACHINES.*

Beam Tests are employed in highway work to determine the quality of the concrete as it is mixed. Usually, beams 6 in. x 6 in. in cross-section and from 30 to 36 in. in length are cast from the concrete. These are kept moist in the same manner as the pavement, and are tested whenever it is estimated the concrete is strong enough to be used by traffic. The beam is loaded in such a manner that the modulus of rupture can be computed. *See also BRICK TESTS.*

Permeability Tests. Concrete exposed to freezing and thawing weather must resist the absorption of water. In addition to the usual "absorption" tests, sometimes water is applied under pressure to one side of a thin concrete disc and the amount of water passing through is measured. In some cases the discs are molded, while in others they are cut out of larger pieces of concrete.

Weathering Tests. *See TIME, EFFECTS OF.*

Rattler Tests are frequently made to determine the wearing qualities of concrete. Ten concrete blocks, eight in. square by five in. in depth, are prepared and placed around the circumference of a special rattler known as the Talbot-Jones machine. A charge of cast-iron spheres weighing 200 lbs. is placed in the machine which is then revolved for 1800 revolutions at a speed of 30 r.p.m. The loss of the blocks expressed in inches is the wear value.

E. E. B.

CONCRETIONS, curious, rounded, stony bodies found in various rock strata. Percolating ground water, carrying mineral solutions through the rocks, is believed to explain the formation of concretions. They grow, layer by layer, about a nucleus, which may be a grain of quartz, a leaf fragment, the bone of a fish, or of a large animal. Concretions range from the size of a pinhead to masses ten feet in diameter. Sometimes mistaken for fossils, or the work of primitive man, their occasionally fantastic forms, as in the "puppchen" or "dolls" of loess deposits, has given rise to folklore. Nodules of flint in chalk, huge limy "turtelstones" in shales, "hornstones" abounding in New York limestones, "clay dogs," or "fairy-stones," and the clay-iron stones, of coal measures, yielding iron ore, are typical examples of concretions.

CONDÉ, LOUIS I. DE BOURBON, PRINCE DE (1530-69), French Huguenot general, was born at Vendôme, May 7, 1530. His father, Duc de Vendôme, was uncle of Henry IV. Condé was educated as a Protestant, was deformed but yet was active in military affairs. He distinguished himself at battles fought at Metz, Piedmont and St. Quentin, but because of his religion his services were not rewarded by the Catholic French court. Later he was in a plot to force the king to recognize the Protestant religion, but was caught and thrown into jail. Shortly afterwards the king died, Condé was freed and soon became one of the leaders of the Huguenot party and head of the army. In the war between the Huguenots and the Catholics he was

defeated at Dreux, fought at Saint Denis, and at Jarnac, Mar. 13, 1569, was defeated and treacherously killed after he had surrendered.

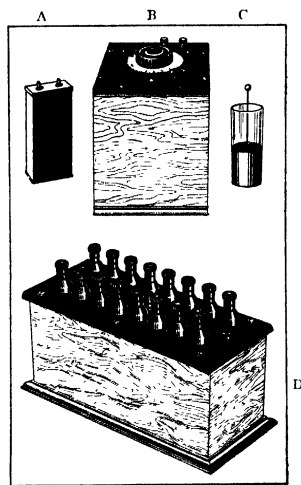
CONDÉ, LOUIS II. DE BOURBON, PRINCE DE (1621-86), French general, called the Great Condé, was born in Paris, Sept. 8, 1621. A great noble, he found himself, after his victory over the Spanish at Rocroy (1643), the most famous general of France. His life subsequently was a series of military successes and political broils. In the war of the Fronde he was first on the side of the regency, but later joined the Fronde, becoming the leader. In 1652 he obtained the command of the Spanish army in the war against France. For this he was proclaimed a traitor, but the charge was withdrawn upon the successful consummation of the Peace of the Pyrenées in 1659. He was offered the crown of Poland (1674), but the king forbade his accepting it. The following year he was given command of the army of the Rhine upon the death of Turenne. After the war he retired to Chantilly, worn out and prematurely old, to live the remaining 11 years of his life surrounded by men of genius. He was conscious of his exalted station, unfeeling, arrogant. His wife, Richelieu's niece, whom Condé had to marry for reasons of state, he treated with consistent harshness until his death at Fontainebleau, Dec. 11, 1686.

CONDENSATION, a term in organic chemistry, used for the process whereby a complex molecule is formed out of two or more, usually different, molecules of less complex structure, with the liberation of water, hydrogen, or some similar simple compound. When two or more molecules of the same substance merely unite in forming a more complex one, usually with different chemical properties, the term **POLYMERIZATION** is employed, while, if the chemical properties of the resulting product are the same but only some of the physical properties different, it is spoken of as **ASSOCIATION**. Thus, several molecules of H_2O , in associating, form liquid water, while three molecules of formaldehyde (CH_2O) polymerize into paraldehyde, and six may ultimately polymerize into a sugar. The terms association and polymerization are often used rather loosely, without adhering strictly to the definitions given above. In one stage of the formation of synthetic formaldehyde-phenolic resins, two different molecules condense into one, while giving off water; similarly, many synthetic dyestuffs are obtained by condensing several molecules into one, such as crystal violet (from 3 molecules of dimethyl aniline and 1 of phosgene) and of the hydrazones (from phenyl hydrazine and an aldehyde or a ketone), in both cases giving off a simple molecule as a by-product.

CONDENSATION OF GASES, in its widest sense, includes all cases involving a change from the gaseous to the liquid state and is thus synonymous with **LIQUEFACTION OF GASES**. However, as generally used, *condensation* is restricted to those cases in which the change of state takes place almost spontaneously at temperatures and pressures not far removed from

the normal. Thus, one speaks of the condensation of water vapor but of the liquefaction of air. Condensation is usually brought about by cooling. The temperature at which condensation of water vapor in the air begins is called the *dew point*. The process is accompanied by an evolution of heat. The use of steam for house heating is an application of vapor condensation. When steam at atmospheric pressure is cooled, it will change to liquid water at $212^{\circ}F.$, and will liberate 970 B.t.u. for each pound condensed. The condensing temperature of a vapor, such as steam, is much lowered, and the rate of condensation greatly retarded, if there are appreciable amounts of non-condensing gases, such as air, present.

CONDENSER, ELECTRICAL, a device consisting of two parallel metal plates separated by air or other insulating substance. The two plates, when connected to a source of electromotive force or to any two points in an electric circuit, become charged with comparatively large amounts of the opposite kinds of electricity. When the two charged plates are connected by a conductor, the negative charge, or **ELECTRONS**, on the one flows towards the other until the two plates are neutral. The quantity of electricity, Q , that flows through the connecting wire in the discharge is proportional to the difference of potential, V , between the



TYPES OF CONDENSERS

A, Metal-enclosed paper condenser, B, variable air condenser, C, Leyden jar, D, mica condenser with taps for different capacities

plates, and $Q = CV$, where C is a constant. The constant, C , called the **CAPACITANCE** of the condenser, depends on the area of the plates, the distance between them and the nature of the **DIELECTRIC** separating them. The unit of capacitance is the *farad*. This unit, however, is too large for practical purposes, so that subdivisions of it are actually used. These are

the *microfarad* and the *micro-microfarad*, which are, respectively, one-millionth and one-million-millionth of a farad.

The fact that two oppositely charged parallel plates have a large capacitance may be explained by noting that the + charge on the one plate raises the potential of the other which has the negative charge, while the - charge of that plate lowers the potential of the plate having the + charge. The difference in potential between the plates then, is lower than it would be without such interaction. The equation, $Q = CV$, shows that, since the interaction diminishes the difference of potential, V , it necessarily increases the capacitance C .

Air condensers usually consist of several connected plates inserted between, and insulated from, a set of similarly connected plates. Air is the dielectric. Such condensers are in general use in radio circuits.

Paper condensers are made by placing a sheet of paraffin paper between two long sheets of tinfoil. These tinfoil sheets are covered with other sheets of paraffin paper, rolled into a compact form, soaked in hot paraffin and finally compressed and inclosed in a container. These condensers are generally used in TELEPHONE circuits and in other service where an inexpensive condenser of large capacitance is required in low-tension circuits.

Mica condensers consist of many sheets of tinfoil separated by thin sheets of MICA, alternate sheets of the tinfoil being connected together. Mica condensers are used as standards for the comparison of capacitance and for the measurement of quantities of electricity.

Condensers are also made with glass or oil as the dielectric. One form of those employing glass is the LEYDEN JAR. Telephone wires are two parallel conductors, as likewise is the underground transmission cable and its lead sheath. These, therefore, act as condensers.

A. Z.

CONDILLAC, ETIENNE BONNOT DE (1715-80), French philosopher, was born at Grenoble, Sept. 30, 1715. He was elected to the French Academy in 1768. His best known work is his *Treatise on Sensations*, which appeared in 1754. Condillac carried Locke's (see LOCKE, JOHN) philosophy to an extreme position and ended in an absolute sensationalism. He derives a human mind from a statue endowed with but one sense, and that sense of the least cognitive significance, the sense of smell. Having experienced two odors, comparison begins. Accompanying these sensations are feelings, and it is only a matter of time when all the rest of an ordinary psychological equipment is brought into play. Condillac died Aug. 3, 1780.

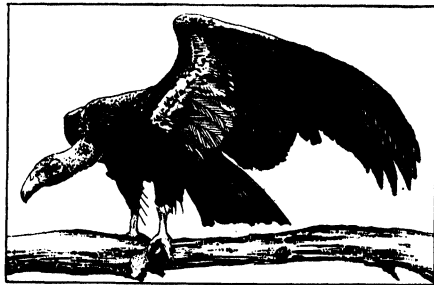
CONDITIONED REFLEX, the neurological basis for that process whereby a like response may take place upon the presentation of a different stimulus, or a like stimulus may be made to provoke a different type of response. The conditioned reflex is the basis for many learning processes, and also for habit formation.

Pavlov's experiment has become classic as an illus-

tration of the conditioned reflex. A hungry dog was placed in sight of food. As the dog would reach for the food a bell was struck over his head. The sight of food had originally caused the dog to salivate. Upon the repetition of this experiment it was found that the dog would salivate upon simply hearing the bell. The bell, which obviously had no connection with food, had been substituted as a stimulus and salivation took place without the food being presented.

Watson has found that in the beginning there are but two things which will provoke fear in the infant, *viz.*, a loud noise or the feeling of lack of support. All the other absurd fears which children, and even adults, have are the result of conditioning. The fear emotion can be induced by any number of objects if one sets about to elicit it. This is similar to the older phenomena of association. Pedagogically the conditioned reflex is most significant in the field of the emotions. By its proper use many unreasonable fears and unseemly manifestations of temper may be controlled.

CONDOR (*Sarcorhamphus gryphus*), a great bird of prey of the American vulture family (*Cathartidae*), found in the Andes, usually at elevations of 9,000 to 15,000 ft., from Peru to Patagonia. It is one of the largest of flying birds, attaining a length of 4 ft. or more and a wingspread of 9 to 12 ft. The male is shiny black, with a white bar on each wing, a bare, wrinkled, reddish head and neck, a fleshy crest on the forehead, a ruff of white feathers about the neck, and conspicuous wattles on the throat. The female, smaller than the male, is duller in color and lacks the comb and sometimes the wattles. The condor is exceedingly voracious, feeding largely on carrion but also attacking various living animals as sheep, goats and small deer. When gorged with food, it becomes



CALIFORNIA CONDOR
North America's largest bird

very stupid and is easily approached and captured. On the wing, it is remarkably graceful, soaring in great circles with scarcely a movement of its wings. The condor breeds in high inaccessible parts of the Cordilleras, laying, in a rude nest of sticks or on the bare rock, two very large white eggs. The young require about a year to learn to fly and seven years to develop mature plumage.

CONDOR, CALIFORNIA (*Gymnogyps californianus*), a huge bird of prey of the American vulture family (*Cathartidae*), called also California vulture. Though formerly ranging from the Columbia River southward to Mexico and eastward to Arizona, it is now restricted to the Coast ranges from San Benito Co., Cal., southward to Lower California. It is a magnificent bird of exceedingly graceful flight, rivaling in size the great South American condor, with a body 44 to 55 in. long and powerful wings spreading $8\frac{1}{2}$ to 11 ft. In color it is dull black, with the tip of the wings and the under wing coverts white, and the bare head and neck yellow or orange. The California condor feeds upon carrion and is exceedingly shy, usually nesting in rocky places and laying one or two very large greenish eggs.

CONDOTTIERE was a term employed in Italy during the later Middle Ages and early modern times to designate a leader of a company of soldiers of fortune. Its plural, *condottieri*, was commonly employed to include the soldiers as well as their commanders. In case of war *condottieri* hired themselves out to the highest bidder and, because of their self-interest, did not hesitate to change sides in the midst of a campaign. As a general rule the wars fought by the *condottieri* were neither savage nor bloody, the purpose of battle being always personal gain rather than the slaughter of the enemy. When not engaged in actual conflict, the *condottieri* frequently resorted to brigandage or dabbled in politics. One of the outstanding *condottiere* of the Renaissance period was Francesco Sforza who became the ruler of Milan in 1450.

CONDUCT, that part of behavior closely associated with moral judgments. Although the term is frequently used to designate types of activity falling outside the moral sphere, conduct usually has reference to ethical situations. It is not proper to designate any kind of activity as conduct; hence the expression "moral conduct" is more or less superfluous.

Conduct presupposes a certain amount of voluntary action. Inanimate objects are said to act and be acted upon but conduct is not attributed to them. Moral judgments are not passed upon the damage done by lightning because no voluntary activity is ascribed to lightning. The same is true of the behavior of animals. Ordinarily their activities are not considered in terms of conduct because of the absence of motive.

Considerable discussion has centered around the question as to whether moral judgments should be based upon the inner or the outer aspects of conduct, the one standing for the emphasis upon motives and the other for that upon consequences. The former position was represented by the intuitionists, the latter by the utilitarians. (See INTUITION; UTILITARIANISM.) The tendency at the present time is to suppose that an act of conduct is unified and that the outer cannot be entirely separated from the inner, nor the inner from the outer. Motives to be worth anything must issue in consequences and consequences that are significant to the judgment of conduct must be intended.

CONDUCTANCE, electrical, the reciprocal of the RESISTANCE of a direct-current conductor or CIRCUIT. According to Ohm's Law, the current in such a circuit is equal to the electromotive force divided by the resistance. In terms of the conductance, the equivalent statement would be that the current is equal to the electromotive force multiplied by the conductance.

In an ALTERNATING-CURRENT circuit the current is given by the electromotive force divided by the IMPEDANCE, a property of the circuit which includes the effects of resistance, INDUCTANCE and CAPACITANCE. The reciprocal of impedance is called *admittance*. This property of the alternating-current circuit corresponds closely to the conductance of a direct-current circuit. In alternating-current theory *conductance* is given a different meaning, being used to designate a certain part of the admittance. In this sense it is defined as the resistance divided by the square of the resistance plus the square of the reactance, the reactance being that part of the impedance due to inductance or capacitance.

L. B. S.

CONDUCTION OF HEAT, the process by which heat is transferred from one part of a body to another without motion of any finite part or parts of it. In conduction there is a continuous gradation in temperature from the hot part to the cold part. That is, the greater thermal agitation (see AGITATION, THERMAL) of the molecules at the hotter part is transmitted to the adjacent molecules, and these, in turn, transmit it to the less agitated molecules near them, and so on. Solids are usually much better conductors of heat than liquids, and liquids are better conductors than gases (see CONVECTION OF HEAT). In general, substances like metals, which are good conductors of electricity, are also good conductors of heat, while substances like glass, porcelain and wood, which do not conduct electricity, are poor conductors of heat. This fact indicates that the same mechanisms are involved in both cases.

The amount of heat which will be conducted per second through a piece of material depends upon many factors, such as its length, its cross-sectional area, the temperature difference between the ends and the character of the material. The *coefficient of thermal conductivity* of a material is defined as the number of CALORIES conducted in one second between the opposite faces of a cube of it one centimeter on an edge, when a temperature difference of 1° C. is maintained between these faces. Engineers frequently use a coefficient defined as the number of BRITISH THERMAL UNITS conducted in one minute between opposite faces of a slab 1 in. thick and 1 sq. ft. in area, when a temperature difference of 1° F. is maintained between these faces. There are several standard methods for measuring coefficient of thermal conductivity.

The mathematical theory of the conduction of heat in solids was worked out originally by FOURIER.

W. W. S.

CONDUCTIVITY, in electricity, the reciprocal of specific RESISTANCE. A conductor offers a resistance to the flow of the electric current which is roughly analogous to the friction effect encountered by a stream

of water flowing through a pipe. The resistance of a conductor depends upon its dimensions, its temperature and the specific resistance of the material in the conductor. The resistance of a given conductor is high if the specific resistance of the conducting material is high. It is low if the conductivity of the material is high. The conductivity of such metals as silver and copper is high; of metals like iron and platinum it is low. This means that iron and platinum wires have high resistance as compared with similar silver or copper wires.

Conductivity is a physical property of a material, and is independent of the size and shape of the conductor into which it is formed. CONDUCTANCE is a property of a circuit, or portion of a circuit, and depends upon the size and shape of the conductors in the circuit and upon the conductivity of its materials.

Conductivity of solutions is a term indicating the facility with which an electric current can pass through them. Whereas an electric current passing through a metallic solid produces no chemical change, a solution invariably suffers chemical decomposition. This is due to the fact that solutions which allow the passage of the electric current contain material in an ionized condition—i.e., the molecules are dissociated into electrically charged particles, called ions. Upon passing the current through the solution the positive ions will be attracted to the negative electrode, or cathode, and the negative ions toward the positive electrode or anode. The conductivity, which is the reciprocal of the resistance, depends upon the number of electrically charged particles per unit volume in the solution, i.e., upon the concentration of the solution and the degree of electrolytic dissociation of the molecules—and on the mobility of the ions. See also IONIC THEORY; ELECTROCHEMISTRY; ELECTROLYSIS; SOLUTIONS.

CONE-SHELL, a member of the family *Conidae* of gastropod mollusks. There are several hundred species, about one-fifth of which live on American coasts. They occur in great variety in the tropics, where they are found on coral reefs, in warm tide-pools, and in rock crevices, usually at depths of from 6 to 24 feet. They have conic shells, showing, as a rule, the typical gastropod spiral at the broad end. These shells are often marked with intricate patterns and beautifully colored. Because of their charm and diversity they are very popular with collectors.



CONE-SHELL
Conus marmoreatus

The animals are carnivorous, with mouths equipped with poisonous teeth, and their bite is said to be dangerous.

CONESTOGA, an extinct Iroquoian tribe that lived formerly on the Susquehanna River and its branches. They were a warlike group, simultaneously in alliance and at war with various Algonkian groups.

They were conquered by the Iroquois in 1675, after which time they established themselves on the eastern bank of the Potomac. They were removed to the Oneida country whence, in 1763, a few returned to Conestoga, their old town, where they were later massacred by white raiders.

CONESTOGA WAGON, the standard vehicle of pioneers' overland travel in the United States, from the settlement of western Pennsylvania through the era of the overland trail. Its first use was in Pennsylvania in 1750-60. The name seems derived from the region of its probable origin, the valley of the Conestoga River, Lancaster County. The Conestoga wagon was heavy, sturdy, with both ends of the bed higher than the middle, and topped by a cloth cover of similar curve. It was the prairie schooner of the emigration to Oregon and California. The stogie, originally Conestoga cigar, was created to meet the preferences of Conestoga-wagon teamsters.

CONEY ISLAND, an amusement resort in Brooklyn, N.Y., at the entrance to New York harbor, situated about 10 mi. from Manhattan. The island is 5 mi. long and in width ranges from ½ to 1 mi. It is separated from Brooklyn by Coney Island Creek; the Lower Bay and the Atlantic are on the south, Gravesend Bay on the west and Sheepshead Bay on the east. Along the shore are Manhattan, Brighton and West End beaches, patronized in season by millions of New York residents. The amusement parks for which Coney Island is chiefly famous are at West Brighton. A boardwalk extends eastward from Sea Gate for more than 2 mi.

CONFECTIONERY is made essentially by evaporating solutions of the crystalline sugars, sucrose and corn sugar, and the non-crystalline sugars, invert sugar and corn sirup to the desired density with or without the addition of other food products. This is done by vacuum, steam pressure, open fire, or hot air, producing materials of a vitreous, plastic, crystalline, or gelatinous consistency. From them are fashioned edible pieces of fanciful shapes and varied colors, flavored with essential oils, fruit and plant extracts or concentrates, preserved fruits, nutmeats, aromatic seeds, pods, or synthetic flavors.

Some of the various forms of candy are: *Amorphous*, or *hard candy*, an amorphous, vitreous product, consisting of sucrose and approximately 15 to 40% non-crystalline sugar, with 1 to 3% moisture; it reverts to a crystalline condition if exposed to excessive humidity. *Plastic* or *caramels* require 50% or more of non-crystalline sugar to prevent crystallization; milk solids or milk and vegetable fats are added to produce body. *Crystalline—creams, fudges* are composed of microscopic sucrose crystals, intimately mixed with sirup, contain 5 to 25% crystalline sugar; they lose water readily; *Gelatinous—gum drops, marshmallows*—are of gelatinous consistency; they are derived from starch, gelatin, gum arabic, agar or pectin with sucrose and corn sirup. *Pan Goods—sugar almonds, jelly beans*—are nutmeats and various other centers coated with sirup in a revolving pan. *Lozenges* are

formed from a dough of pulverized sugar and solutions of gum arabic or tragacanth, gelatin, corn syrup, and dried until brittle. J. H.

BIBLIOGRAPHY.—Matthew Berman, *The Why and How of Candy Making*.

CONFECTIONERY INDUSTRY, UNITED STATES. This industry embraces establishments engaged primarily in the manufacture of candy, confections, cake ornaments, salted nuts and related products.

CONFECTIONERY MANUFACTURE, U.S., 1914-1929

Year	No Establishments	Wage Earners	Wages \$	Value of Products \$
1914	2,317	51,610	20,643,633	153,685,523
1919	3,149	76,493	54,461,057	447,726,103
1925	1,931	63,600	55,234,527	379,081,441
1929	2,021	63,501	56,442,674	393,269,849

CONFEDERATE STATES OF AMERICA, the title of the independent government formed by the southern states who seceded from the Union, 1860-61. Its president was JEFFERSON DAVIS; its vice-president ALEXANDER H. STEPHENS. Delegates from the first six states to secede met at Montgomery, Ala., Feb. 4, 1861 and adopted a provisional Constitution tacitly accepted by the states then and thereafter in its membership. All laws of the United States in effect on Nov. 1, 1860, and not inconsistent with the provisional Constitution, were continued. On the 9th a president and vice-president were elected, and Davis was formally inaugurated on the 18th. His first cabinet contained Robert Toombs, Ga., Secy. of State; Charles G. Memminger, S.C., Secy. of the Treas.; L. P. Walker, Ala., Secy. of War; Stephan R. Mallory, Fla., Secy. of the Navy; Judah P. Benjamin, La., Att.-Gen.; and John H. Reagan, Tex., Post-Gen. Later eminent members included R. M. T. Hunter, Va., Secy. of State, July 30, 1861-Feb. 7, 1862; James A. Seddon, Va., Secy. of War, 1862-65; Thomas H. Watts, Ala., Att.-Gen., Sept. 10, 1861-Nov. 10, 1863. Benjamin, the most brilliant of the group, was successively Secy. of War and, after Hunter, Secy. of State.

The permanent Constitution, adopted by the provisional Congress on Mar. 11, 1861, and subsequently ratified by the several states, left the war powers of the Government unchanged from those provided in the Federal Constitution. Only those portions of the Constitution applicable to war conditions were ever put into operation. Interesting divergencies from the Federal Constitution were provisions that no protective tariff should be levied for the benefit of any branch of industry; no public moneys were to be appropriated for internal improvements, except for aids to navigation which should bear their own cost; the President could veto separate items in appropriation bills; the presidential term of office was six years, and reelection was prohibited.

The Government collapsed with the surrender of its army at APPOMATTOX, Apr. 9, 1865. Its constituent states, together with the dates of the respective ordinances of secession, were: South Carolina, Dec. 20,

1860; Mississippi, Jan. 9, 1861; Florida, Jan. 10, 1861; Alabama, Jan. 11, 1861; Georgia, Jan. 19, 1861; Louisiana, Jan. 26, 1861; Texas, Feb. 1, 1861; Virginia, April 17, 1861; Arkansas, May 6, 1861; Tennessee, May 7, 1861; and North Carolina, May 20, 1861.

BIBLIOGRAPHY.—J. K. Hosmer, *Outcome of the Civil War*, 1907, pp. 311, 314-20, 323 and 326. See also J. D. Bulloch, *Secret Service of the Confederate States in Europe*, 2 vols., 1884; J. C. Schwab, *Confederate States of America, Financial and Industrial*, 1901; J. M. Callahan, *Diplomatic History of the Southern Confederacy*, 1901; A. B. Moore, *Conscription and Conflict in the Confederacy*, 1924; F. L. Owsley, *State Rights in the Confederacy*, 1925; and W. M. Robinson, *Confederate Privateers*, 1928.

CONFEDERATION, a loose league of peoples or states, bound together for some common purpose, with each unit retaining its full sovereignty and the right to withdraw from the confederation. In this essential respect a confederation differs from a federation, where the sovereign unit is the whole, and not the component parts. The German Confederation brought into existence by METTERNICH at the CONGRESS OF VIENNA is an outstanding example of a modern confederation, and exemplifies the chief weakness of this form of government. As in the United States under the Articles of Confederation, state jealousy and insistence upon states' rights can be so strong as to render the confederation powerless. In the modern world, due to nationalism and the development of highly centralized states, the confederation as a political form plays little part.

BIBLIOGRAPHY.—J. W. Garner, *Introduction to Political Science*, 1910.

CONFEDERATION, ARTICLES OF, the basis of national organization, 1781-89, of the 13 American states who participated in the REVOLUTIONARY WAR. In the Second CONTINENTAL CONGRESS on June 7, 1776, Richard Henry Lee of Virginia moved that a plan of confederation be submitted to the several colonies. On June 12 a committee composed of one member from each colony and including John Dickinson, Samuel Adams, and Edward Rutledge was formed to draft articles of confederation. Largely the work of Dickinson, the articles were submitted to Congress on July 12, 1776, and after modifications by Congress were presented to the states, Nov. 17, 1777, for ratification by the several legislatures. Maryland was last to ratify, Mar. 1, 1781, its legislature having delayed until assured that the states having claim to western lands would cede title to the Confederation. The articles provided for a congress of delegates, of indefinite number, annually chosen in the states, each state delegation to vote as a unit. Congress had authority to declare and wage war, to build and equip a navy and make rules for the government of land and naval forces, to send and receive ambassadors and make treaties, to settle disputes between the states, to regulate the value of all coin struck by the United States or by any state, to control relations, trade and diplomatic, with the Indian tribes, to borrow money and emit bills of credit, to fix standards of weights and measures, to establish post offices, and to settle disputes between the states. An extraordinary ma-

jority, the vote of nine states, was necessary for the enactment of measures of importance; no vote, except the day's motion for adjournment, could be carried except by the vote of seven states. The free inhabitants of each state were declared entitled to all the privileges and immunities of citizens in the several states, as a facilitation of communication and commercial intercourse. The states were debarred from entering into treaties or alliances, interfering in foreign affairs, or, unless in fact invaded, engaging in war without the consent of Congress. All powers not expressly assigned to Congress were reserved to the states.

The sole provisions toward the establishing of an executive department were that a member of Congress should be appointed to preside over its sessions, no one person to serve as a chairman more than one year in any three; and that civil officers for managing the general affairs of Congress should be appointed. The only provision toward a judiciary authorized prize courts; but each state was required to give full faith and credit to the judicial records and proceedings of every other state. Regulation of foreign and interstate commerce remained a prerogative of each state. The articles did not authorize Congress to levy and collect taxes; Congress could but determine the sums needed and apportion those amounts among the states, for collection at the volition of the states, upon the basis of the value of real estate in each. The vital weakness of the Articles of Confederation was the theory inherent in such a confederacy of sovereign states, that the National Government should be limited to dealing with the states and not with individuals.

BIBLIOGRAPHY.—A. C. McLaughlin, *Confederation and Constitution*, 1907. C. E. Merriam, *A History of American Political Theories*, 1920; R. G. Gettell, *History of American Political Thought*, 1928.

CONFESSION, in law, an admission of a wrong, a debt or any liability adverse to the one confessing. "A confession in **CRIMINAL LAW** is the voluntary declaration made by a person who has committed a crime or **MISDEMEANOR**, to another, of the agency or participation he had in the same." (People *vs.* Strong, 30 Cal. 151.) An admission of some connection with the crime is not held to be confession. "A confession is an admission of guilt meant to be such." (State *vs.* Carr, 53 Vt. 37.) For example, "a statement, made by one arrested for assault, that he was sorry he did not kill the person assaulted is not a confession." (Corporal *vs.* State of Texas, 24 S.W. 96.) Also a New York case held that a statement by the accused, that he knows who committed the crime, was present at its commission and knows how it was done, was not a confession.

CONFESSION, in the sphere of religion, a term having at least four principal meanings: an acknowledgment of God's attributes in ritual worship; formulation of a creed; burial place of a Christian confessor or martyr; and accusation of oneself with sin. In the last sense it has been a practice of various churches,

following the New Testament suggestion, to require it as a public statement at baptism or in connection with ritual worship. The Catholic Church views confession as part of the virtue of the sacrament of penance, by which the penitent accuses himself of his sins and is granted God's forgiveness by the priest. This is sometimes called auricular confession, being privately imparted to the ear of the priest. Sins may be confessed in general or in detail, but the Church emphasizes that God, not the priest, forgives and only when there is sincere sorrow and the purpose to amend, without which the act avails nothing. The Church holds that confession was authorized to the apostles and their successors by Christ's command and the "power of the keys."

Confession is limited to serious sins as distinct from venial or trivial offenses. Mortal sins must be confessed and absolution must be obtained before the penitent receives Holy Communion. The confessional is strictly secret. In order that abuses may be prevented, it is now usual for the priest, when discharging this function, to sit in a "confessional box" unseen by and entirely separate from the confessing penitent.

Children are taken to confession from the age of seven onwards, and a confession at least once a year is obligatory.

CONFIRMATION, in relation to the Christian churches, is usually regarded by those non-Catholic churches which recognize it as an assumption or confirmation by the individual believer of the profession of faith made at baptism on his behalf by parents or sponsors. It is sometimes attended by an examination into the beliefs of the candidate. In the Roman Catholic Church it is one of the sacraments by which the Holy Ghost is given to those already baptized, to confirm and strengthen them in the faith. It is a ceremony administered by a bishop with the laying on of hands, prayers, anointing with chrism and "a slight blow on the cheek" when the benediction is bestowed. The Greek Church omits the laying on of hands. A sponsor stands for each candidate and must be of the same sex, and not a parent or baptismal godparent.

CONFLICT OF LAWS. This division of law is sometimes called Private International Law. The rules of Conflict of Laws are part of the municipal law of each state. They deal with the extent to which the laws of a given state operate, and determine whether the law of one or another state shall be applied to a legal situation. Every question in which legally significant facts have occurred in more than one state thus has a Conflict of Laws element in its solution, and the problems necessarily cut across the whole field of the law. Many of them are similar to questions treated in Public International Law, although Conflict of Laws is generally thought of as dealing with rights and liabilities of individuals and not with relations between states.

While the theories of Conflict of Laws have been discussed by Continental jurists for many years, the

development in Anglo-American jurisprudence is of very recent date. Our rules of law have developed here, as in other parts of the common law, by the building up of precedents of courts in individual cases. Conflict of Laws is assuming an increasingly large and important part each year in the growth of our law. The reason lies in the present quick and easy communication of people in personal and business matters across political boundary lines. When an individual is born, lives, and dies within the borders of a self-contained community, his affairs present small possibility of questions where a choice must be made of applying the law of one or another state. But where interstate and international journeys are common in the lives of everyone, an innumerable number of possibilities for Conflict of Laws questions arises. Many of these possibilities ripen into litigation and the current reports of decisions in both federal and state courts in this country contain many opinions each month dealing with various phases of the subject.

In this growing stage, it is not to be expected that either rules or theories will be well settled as in those branches, such as Contract and Property Law where the development has taken place through several centuries. Some of the basic considerations, however, seem fairly clear. For example: A court in settling a dispute between parties applies only the law of its own state. But if one man sues another in England upon a contract made and performable in France, it is not fair to measure his rights by the rules applicable to similar contracts made in England. The English court will determine the case by English law, but as part of its law it will apply the Conflict of Laws rules it has worked out concerning contracts made elsewhere. Fairness demands that if an individual has acquired rights or incurred liabilities under the law of one state, the measure of his rights and liabilities should not be changed by the fortuitous circumstance of the place of suit. This is the decided tendency of the decisions, subject to the reservation that a court will refuse enforcement of a right acquired under foreign law if it deems such enforcement contrary to local policy.

Conflict of Laws is particularly interesting in the United States. In matters of private law each state is sovereign and independent, subject only to the limitations of our Federal Constitution. Every transaction with a two-state element presents as much of a Conflict of Laws question as one which is international in the wider sense of that term. The desirability for a well considered and fair system of legal rules and their uniform application is obvious. An additional element of interest also is found in several clauses of the Federal Constitution. Among these are the "full faith and credit" clause, the "due process" clause of the Fourteenth Amendment, the "equal privileges and immunities" clause and, to a lesser extent, the "interstate commerce" clause. The interpretation of the Constitution by the Supreme Court of the United States is of compulsory authority upon the states. That interpretation in matters concerning Con-

flict of Laws has on the whole been decidedly in the direction of limiting the states to the control of affairs within their own borders on the one hand, and, on the other, to compulsory recognition and enforcement of rights acquired in other states. Both results are highly desirable.

Mr. Justice Joseph Story was the first scholar of note in Conflict of Laws in this country. His treatise on the subject, in its later editions, is still highly regarded. Dicey on Conflict of Laws is probably the leading English book. The American Law Institute is making a restatement of the common law of Conflict of Laws which, when completed, will be of high authority.

H. F. G.

CONFORMAL REPRESENTATION, a transformation of a figure in the plane in which a complex variable $z = x + yi$ is represented, to another plane in which $w = u + vi$ is represented, w being an analytic function of z , such that any angle in the z -plane is unchanged in the w -plane. See FUNCTIONS OF A COMPLEX VARIABLE; COMPLEX NUMBERS.

CONFUCIANISM, a system of Chinese moral and political philosophy, formulated primarily by CONFUCIUS and fostered by Mencius, Hsun-tze, Chu Hsi and others. The term is of Western origin, due to its use by Catholic missionaries. The historical Chinese term is Ju-chiao, or "Scholar's teaching." It is the only ancient culture of great magnitude which has maintained itself until to-day in an unbroken line of dominance in the life of a great people. The approach to the inner character of China must still be made through the Confucian tradition, in spite of many adverse elements in the distracted present. The literary sources of Confucianism are nine writings in two sets of five and four, respectively, which altogether cover a period of time from about 2000 B.C. to the 2nd century. They are "Confucian" in merely an indirect sense, as being edited by him, or written by his disciples—save for one work, the Annals of the State of Lu, part of which he himself wrote. There are: (1) the Book of History, a collection of ancient state papers, imperial memoranda, and the records of conversations between rulers and ministers; (2) the Book of Poetry, a body of sacrificial odes, songs and ballads; (3) the Book of Changes, a fanciful system of philosophy, or divination; (4) the Book of Rites, consisting of things to be "remembered" and done precisely at ceremonies, and rules for individual conduct, and (5) Spring and Autumn, or the Annals of Lu; and (1) the Analects of Confucius, a collection of sayings of the Sage; (2) the Great Learning, politico-moral philosophy for rulers; (3) the Doctrine of the Mean, treating of the human mind and its virtuous expression, and (4) the Book of Mencius, a commentary upon the qualities of the righteous ruler, and the essentials of a rightly governed state.

Confucian morality is characterized by a keen sense of duty performed in accord with the very law of man's nature. It is fundamental to Confucian theory that man by nature is good, that-through obedience to the moral law man maintains his natural goodness,

and that, by concentric waves of influence, men, from the emperor down to the masses, effect through self-development the control and welfare of the family, the community, and the state. The Confucian symbol of the moral law is *Jen*, "true virtue" and the sum of all virtues, moral excellence shown spontaneously. *Jen* as the sum of all the virtues consists of (1) *Jen*, in any particular sense, as loyalty, purity, "love to mankind," etc.; (2) *I*, duty, faithfulness, justice; (3) *Chih*, knowledge, perception, experience, insight, especially knowledge of men; (4) *Hsin*, truth in speech, sincerity, and (5) *Li*, propriety, ceremony, politeness, reverence, worship. The Confucian sense of duty, or—more broadly, virtue—has found expression in what is known as "filial piety" (*hsiao*, a character composed of a sign for an "old man" and a supporting sign of a "young man"). The root of filial piety is the family and the home; its extent is boundless. It prevails, ideally, in these relations: (1) ruler-subject, administrator-citizen; (2) father-son (and mother-daughter, by implication); (3) elder brother-younger brother; (4) master-servant; (5) friend-friend; (6) husband-wife, and (7) host-guest. Confucius himself assumed ultimate distinctions of class and rank in the social structure which he would renovate. He referred to the past as containing every principle necessary for man's complete development, after the fashion of perfect ancient examples of character and government.

Confucianism (especially Confucius) recognizes Heaven and the spirits, but in general attitude is agnostic. Heaven is to be obeyed and the spirits, especially ancestral spirits, are not to be neglected, but Confucian duty refers mainly to the present life and human relationships. According to Confucianism, the State has been charged with the obligation of prayer and sacrifice to Heaven, and other powers, on behalf of the people and the national welfare. The people as such have directed their thought and worship to their own ancestral spirits. Confucianism has been, on the one hand, the religion of the Chinese State, and, as such, a system of politico-moral philosophy, mainly. This is the "Scholar's Teaching." It has been religious in so far as it has conserved the elements of religion (nature and ancestor-worship) found in the ancient order. On the other hand popular Confucianism has been expressed mainly in the commemoration of ancestral spirits.

J. C. A.

BIBLIOGRAPHY.—E. Faber, *The Doctrines of Confucius*, 1902; H. A. Giles, *Confucianism and Its Rivals*, 1915; C. Y. Hsu, *The Philosophy of Confucius*, 1926; D. W. Lyon, *Religious Values in Confucianism*, 1928.

CONFUCIUS (551-479 B.C.) or Kung-fu-tze, "Kung the Master Sage" of China, the founder of a "religion" and a family which have endured to the present. He was born in the principality of Lu (included within the modern Shantung) when China was comparatively small and almost surrounded by encroaching barbarians. Outside pressure and inner strife prevailed, amidst which Confucius sought the means to peace, harmony, and the people's welfare.

Confucius was reared by his young, religious-minded mother; he was grave, humane and reverent, and devoted to prayer and sacrifice. His formal education was begun with the local magistrate, and at 15 years of age he had a decided bent toward learning. At 17 he was a clerk of revenue; at 19 he married, having one son, Li, and a daughter born to him; during his twenties he conducted a school, admitting to it all who were earnest in study. From 35-50 years of age, he devoted himself to research. At 50, when he "knew the decrees of Heaven," as he said, he took public office again, serving as assistant superintendent of public works and chief justice of the state of Lu. One of his theories at the time was that the chief business of the state was not revenue but the proper functioning of the citizens. For various reasons his program was not followed; instead, he was dismissed from Lu and became an exile at other courts, still without political success. During his wanderings he retained confidence in himself, and was accompanied by disciples who believed in him. At the age of 68 he was back in Lu, by invitation, where he spent his remaining years completing his researches, writing the *Annals of Lu*, and editing the works known as "The Confucian Classics." (See CONFUCIANISM.) For 2,000 years Confucius has been worshiped by the Chinese, and China has been exalted through him. His place in China to-day is, however, a widely-discussed question.

J. C. A.

See W. E. Soothill, *The Analects of Confucius*, 1910; M. Magre, *Confucius and his Quest*, 1929.

CONGLETON, a municipal borough of east Cheshire, England, lying in the deep valley of the Dane, about 160 mi. northwest of London. The town is thoroughly modernized, only several old half-timbered buildings remaining, three of which are inns. In the 16th and 17th centuries the town was famed for leather laces known as Congleton points, and in the middle of the 18th century it took to silk-spinning. But to-day fustian manufacture is of chief industrial importance, with the coal, tobacco and agricultural trades secondary. Pop. 1921, 11,762; 1931, 12,885.

CONGLOMERATE, rubble rock, composed of rounded pebbles or boulders, embedded in a finer matrix as in cement. Conglomerates are consolidated pebble-beds, laid down in shallow water along sea or lake shores, or in rivers. The embedded fragments of any kind of rock, may range from pea-size to boulders 10 ft. in diameter. When they are conspicuously coarser than the limy or sandy cementing material, the rock is called pudding-stone. Breccias, made of angular fragments set in a matrix, are often polished like marble, but conglomerates are used only for rough foundation work. Well cemented conglomerate, consisting predominantly of hard quartz pebbles, makes resistant rock, as may be seen in the erosion-defying peaks and ridges of the Delaware Water Gap. Conglomerates sometimes contain valuable ores, as in the Calumet and Hecla mines, where native copper permeates the mass, or the vein-quartz conglomerate

of the African Transvaal, which contains gold in both the pebbles and the matrix.

CONGO, a river of central Africa, in respect to its basin the largest African river and the second largest river in the world, with an estimated length of 3,000 mi. The native name of the river is Zaire or Dzaire.

Congo Basin. The basin of the Congo covers an enormous area in central Africa, estimated at more than 1,400,000 sq. mi. This region stretches from about 8° 30' N. to 14° 30' S. lat. and from 13° to 34° E. long., but suddenly contracts to a width of one or two degrees between Stanley Pool and the Atlantic. A line drawn from Addis Ababa in Abyssinia to Yola in the east of Nigeria would almost touch the most northerly part of the basin; the most southerly section extends to the southern limits of Katanga and the most easterly to the water-divide west of Lake Tanganyika Territory.

By far the greater portion of this immense basin consists of a vast central plateau, comparatively low in height, traversed by a large number of tributary waterways, some of great size, which find their only outlet to the sea through a deep gorge, so narrow in parts that it has been impossible to run a railroad through it. This gorge, or series of narrows, confines the lower reaches of the Congo between Matadi and Leopoldville. It has been cut by the river through the Crystal Mountains, a range of hills of crystalline formation which run from Cameroon into Angola, at the back of two parallel coastal plateaus. The Congo has burst from its original course and now flows westward to the Atlantic, a very large part of the present basin having once been a great inland sea. The only portions of this formerly submerged region now remaining are Stanley Pool, Lake Leopold II and Lake Tumba; but some areas are still subject to inundations and others generally remain marshy. This section is enclosed by higher ground on the north, east and south, and thus in the true sense forms a great interior basin in the center of Africa.

Sources and Outlet. The Congo rises south of Lake Tanganyika, and, passing through LAKE BANGWELO, in the swamps of which Livingstone died, is known as the Luapula. It is seriously obstructed before reaching Lake Mweru; then, after leaving this lake, it joins another upper stream from the Katanga plateau to form the Lualaba. Frequently interrupted by rapids, the Congo then flows northward, to cross the equator at Stanley Falls. Here it enters its middle basin, and now provides nearly 1,000 mi. for navigation, despite its frequent division into numerous channels. The Congo is commonly a very wide river, with many islands in this part of its course, which finishes at Stanley Pool. Below this point it descends by Livingstone Falls from Leopoldville (950 ft.) to Matadi (85 ft.) in a course of 220 mi. Below Matadi the Congo estuary is 5 mi. broad for about 100 mi. to the Atlantic, but shifting sand banks and a very strong current, especially in the rainy season, make navigation difficult. The Congo is one of the few

ivers of Africa with no delta, but the powerful current in the estuary carries a great volume of muddy water far into the Atlantic.

It is obvious that the Middle Congo and its tributaries provide a remarkable network of navigable waterways, but the river as a whole can never have a unifying influence upon the population of the basin because of the interruptions in navigation and the lack of access to the sea. Nevertheless, the political divisions illustrate the importance that was at first attached to the stream as a possible waterway; it was internationalized towards the end of the 19th century, and the middle river for part of its course became the common frontier between French and Belgian territory.

Tributaries. The following are the chief navigable tributaries of the Congo, on the left bank proceeding downstream (most of these rivers are blocked in places by rapids, and some are only open to navigation during the rainy season): 1. Lomani, running parallel with the main river; 2. Lualaba and Lopori; 3. Ikelemba; 4. Ruki, fed by numerous navigable tributaries and consisting of about 1,200 mi. of navigable waterways; 5. Kiwa, afterwards becoming the Kasai, embracing with its tributaries the Kwango, Lulwa, Sankuku and Lukene, about 1,500 mi. of navigable waterways, and draining the whole of the western portion of the Congo basin. On the right bank of the Congo numerous large tributaries provide useful routes into northern Equatorial Africa: 1. Aruwimi, rising in the watershed west of the Kilo and Moto goldfields and entering the Congo at Basoko; 2. Itimbiri, farther on known as the Rubi, entering the Congo at Moenge; 3. Mongala; 4. Ubangui, an immense river draining the south of French Equatorial Africa, and by means of its main tributary, the Welle, the northeastern portions of the Belgian Congo. The Ubangui is navigable upstream to Bangui and, with great difficulty, to Mobaye. The Welle is stated to be navigable for some 400 to 450 mi. 5. The Sanga, joined near its confluence with the Congo by the Likuala, is navigable as far as Wesso and, beyond that point, well into Cameroon, the southeast portion of which, with tributaries, it drains.

The Congo and its many allied streams provide nearly 11,000 mi. of navigable waterways in Central Africa above Leopoldville. The main stream does not vary in volume so much as other great African rivers, and there is no obstruction for 1,000 mi. below the Stanley Falls, while it is navigable in several sections above this point. Livingstone Falls have been a most serious hindrance to the development of this part of the continent, as cargoes have to be transferred to the railroad which runs to the port of Matadi.

Navigation. The Congo forms a great navigable route into the interior of Africa, and it is possible to travel by water and railroad from the mouth of the Congo to Cape Town or across Africa to Dar-es-Salaam. Passenger service, though regular, is slow, and uncertain on the upper reaches of the Congo

during the dry season. In addition to being the main entrance to Belgian Congo, the river is also the principal route to FRENCH EQUATORIAL AFRICA, reached circuitously by proceeding from Brazzaville, on Stanley Pool, up the Congo and Ubangui, then up the Tomi to Fort de Possel, whence portage is made across the divide via Fort Sibut to Fort Crampel on the Gribungui river. The route is then down the Gribungui and the Shari to LAKE CHAD.

Discovery. In 1487 the Congo was discovered by the Portuguese naval officer, Diego Cão, who named it *Poderoso*, or "the Mighty." In 1861 a British expedition explored the entrance; LIVINGSTONE followed in 1867-71.

CONGO, FRENCH. See FRENCH EQUATORIAL AFRICA.

CONGO SNAKE, a popular name for a species (*Amphiuma means*) of amphibian which resembles a snake or an eel. Only by looking closely can its four minute and useless legs be seen. The creature is grayish brown, and about 2 ft. long. It is found in muddy ponds, rivers, swamps and irrigation ditches in the southwestern part of the United States.

CONGREGATION, a term applied: (1) to monastic organizations; (2) to committees or departments organized to transact the business of the papal see.

(1) In the Middle Ages groups of monasteries, such as the houses dependent on Cluny or Cîteaux were termed congregations. The fourth Lateran Council, 1215, ordered monasteries of every kingdom or province to unite into congregations, a direction reiterated by the Council of Trent. To-day, congregations are organizations which resemble the religious orders but lack some of their characteristics. The members of some congregations, e.g., the Redemptorists, are technically "Religious" but they do not take solemn vows; others, such as the Oratorians, are groups of seculars.

(2) The establishment of committees of cardinals to assist the Holy See is attributed to Sixtus V, 1588, but the oldest of these Roman congregations, the Holy Office, dates from the pontificate of Innocent III, 1198-1216. The newest, that of Seminaries and Universities, was established in 1915. There are now 12 Roman congregations, each charged with particular duties in directing the life, activities, worship, and discipline of the Church.

CONGREGATIONALISM, a system of ecclesiastical organization which recognizes the power of each local church or religious fellowship to control its own affairs. It commonly implies that every church member, irrespective of sex or position, has an equal voice in the conduct of the business of the church unit, and is equally subject to its control. Not infrequently this rule is combined, without surrendering the autonomy of the local church, with an intercommunication and cooperation with other churches by means of conferences and common activities. This policy is common to all Congregational churches, specifically so-named as a religious denomination. (See CONGREGATIONALISTS.) It also characterizes the gov-

ernment of many Christian denominations and churches not specifically called Congregational, the chief of which in the United States are the following: the various Adventist bodies (see ADVENTIST CHURCHES), the Assemblies of God, the numerous Baptist denominations (see BAPTISTS), the CHRISTADELPHIANS, the CHRISTIAN CHURCHES, the CHRISTIAN UNION, the CHURCHES OF CHRIST, the DISCIPLES OF CHRIST, the HOLINESS CHURCHES, the various Lutheran denominations (see LUTHERANS), the MENNONITES, the Congregational Methodist bodies, the Pentecostal churches of the Nazarene, the Scandinavian Evangelical churches, the Spiritualists (see SPIRITUALISM), the Universalists (see UNIVERSALIST CHURCH), and the Unitarians (see UNITARIANISM).

CONGREGATIONALISTS, primarily those Christians who believe in the church polity which vests all power in the local church, in the conduct of the business of which each member has an equal voice. (See CONGREGATIONALISM.) More particularly, Congregationalists are members of the Christian Protestant denomination known as the Congregational Churches, earlier known as the Independent Churches, which is to-day an important religious body in nearly all Christian countries. In England and some of the British colonies it still retains in various ways, its older name of the Independent Churches. In many of the older communities of New England, the Congregational Churches are sometimes distinguished from the Unitarian churches, which are also congregational in both polity and origin, by the appellation Orthodox or Trinitarian.

Origin in English Reformation. Congregationalist scholars have written much to set forth the approximation of their form of church government to that of the primitive Christian church. Historically, it had distinct origin in the English Reformation, when the English church divided into Anglicans, Puritans and Separatists, the Congregationalists being the present representatives of the last group. The Separatists from the beginning held that a nationally established church could not be fully Christian, and they early withdrew from the national church, especially after the Act of Uniformity was passed early in the reign of Queen Elizabeth. In 1581 some of them, under the leadership of Robert Browne, emigrated to Holland, from which country they conducted an active propaganda in behalf of their religious views. For furthering the movement in England, many of their fellow-believers were persecuted and some hanged. In 1604, during the reign of James I, the Anglican clergyman, John Robinson, adopted the teachings of the Brownists, as the first Congregationalists were sometimes called, and exiled himself and his congregation from his parish at Scrooby in England to Amsterdam in Holland, settling subsequently in Leyden. In 1620 these Holland exiles composed the passengers who sailed on the Mayflower from Plymouth for America, and who have been known since as the PILGRIM FATHERS. They formed the first Congregational church on American soil.

The United States. Congregational churches in the United States originated with the landing of the Pilgrim Fathers at Plymouth, Mass., in 1620, who organized the first Congregational church on American soil. A little more than 20 years later not only were all the churches of New England Congregational, but Congregationalism was practically the state religion, and in Massachusetts the political franchise was limited to the members of these churches until 1665. Until the late 18th century the salaries of the Congregational clergy were secured in many of the older New England communities by a public tax. With the gradual increase of Episcopalians, Quakers and Baptists, the connection of the Congregational churches with the state disappeared.

Early American Congregationalism was actively related to four great movements which deeply affected its own history and the larger history of America: (1) It took the initiative in 1734 in the religious revival under Jonathan Edwards, known as the Great Awakening. (2) Its members, notably John Hancock and the Adams family, were leaders in the political revolution which gave birth to the republic. (3) In the early 19th century it suffered the loss of about 100 of its most important churches, which under the leadership of men like William Ellery Channing joined the newly established Unitarian movement. (4) With the opening up of the West, it established a union with the Presbyterians which resulted in "the practical elimination of Presbyterianism from New England, and of Congregationalism from the new communities of the West."

With the growth of denominational consciousness, the local churches united in the formation of national societies, the most important of which were the American Board of Commissioners for Foreign Missions, 1810; the American Home Missionary Society, 1826, and the National Council. The regular work of the churches to-day extends to foreign and home missions, church building, religious education of the young, and the support of colleges, many of which were established as Congregational colleges, although not so denominational to-day. More than 40 colleges in the United States owe their origin to the Congregational churches, including Yale, Williams, Dartmouth, Bowdoin, Amherst, Oberlin, Beloit, Carleton, Drury and others. Harvard was founded in 1636 as a Congregational college, but later passed under Unitarian influence.

Congregational churches are most numerous in the states of Massachusetts, Connecticut, Illinois and New York, although their number and membership in New York State is only about half as large as in Massachusetts. Twenty-eight per cent of the Congregational churches in the United States are still to be found in New England. The strength of the denomination outside of New England and the states already mentioned is greatest in Ohio, Iowa, Michigan and California. The total membership in all states in 1929 was 940,802, meeting in 5,419 churches, valued at \$187,933,616. Since 1929 the strength of this form

of organized Christianity has been greatly strengthened by a union with the Christian denomination, which has added about 1,000 churches to the total already given. (See below.)

Doctrines of Churches. Congregationalists have never made any creedal statement the condition of membership in their churches, but there have been several attempts to give forth a consensus of opinion, which while never regarded as binding, have been widely accepted as fair presentations of the doctrinal position of Congregationalists. One of the earliest of these was known as *The Cambridge Platform* and simply registered a general agreement with the *Westminster Confession*. In 1680 a revision of the *Savoy Confession* was made. In 1708 the *Saybrook Platform* embodied modifications of polity but still approved the general doctrinal positions of the older *Westminster Confession*. The first National Council in 1865 adopted *The Burial Hill Declaration*, which did service until 1880 when the National Council asked a commission to formulate "the doctrines that we hold to-day." The commission was made up of 25 men who finished their work in 1883 and it was published without formal adoption "to carry such weight of authority as the character of the commission and the intrinsic merit of its exposition of truth might command." A further demand of this character grew up in 1913, and the platform adopted by the National Council that year has served since to set forth the practically unanimous views of Congregationalists.

Union With Christian Churches. In 1929 occurred one of the most notable events in the history of modern Congregational churches. Their National Council and the General Convention of the Christian Churches unanimously adopted a plan of union of the two denominations which contemplated complete fusion into a single body at the earliest feasible date. This union was consummated in 1931. The plan provided only for immediate practical unity. Each group of churches and each individual church is free to retain and develop its own form of religious expression, and no uniformity of religious opinion is

Countries	Churches and Stations	Membership
Africa	1,356	49,830
Australia and New Zealand	516	21,187
Brazil	163	3,589
British Guiana	46	4,319
Bulgaria	40	1,443
China	1,067	33,089
Czechoslovakia	150	3,694
India and Ceylon	1,582	44,918
Ireland	52	2,148
Jamaica	46	3,139
Japan	281	27,839
Madagascar	874	42,488
Mexico	25	563
Micronesia	76	3,214
Newfoundland	16	390
Papua	84	3,771
Philippines	61	3,963
Scotland	165	37,882
South Seas	292	19,708
Spain	8	349
Turkey, Greece, Syria	66	3,584

required. The Christian churches numbered about 1,000. The united group is now known as the Congregational and Christian churches of the United States.

Outside of the United States and Canada, Congregationalists are strongest in England and Wales, the land of their origin, where they have 3,469 churches or chapels and a membership according to the census of 1929 of 314,082. Representing the same date, the Congregationalists of the world, apart from the United States, England and Wales, have been reckoned in the accompanying table, which includes the statistics of missionary stations under the control of the Congregationalist missionary societies, the American Board of Foreign Missions, the London Missionary Society, and the Colonial Missionary Society.

CONGRESS OF THE UNITED STATES, a bicameral legislative body in which is vested the legislative authority of the Federal government. The SENATE or upper house, is composed of 96 senators who are elected by popular vote, two from each state. The HOUSE OF REPRESENTATIVES, or popular body, has a membership of 435. The seats in the popular chamber are apportioned among the states in proportion to their relative populations; the representatives are chosen in theory at least from compact contiguous districts. The term of a representative is two years, that of a senator, six. Although the Senate is a continuous body, one third of its members retiring every two years, the life of a Congress is determined by the term of the members of the House of Representatives. (For the powers of Congress, see HOUSE OF REPRESENTATIVES.) Legislative organization and procedure in Congress is somewhat unique and can best be described perhaps by treating each chamber separately.

Sometime before the opening of a new Congress the members of each party in the House of Representatives hold a CAUCUS at which they determine upon the representative the party will support for the post of presiding officer—Speaker of the House. The Speaker, unlike the presiding officer of many European parliaments, is not a moderator but rather a partizan leader. At the same time the caucus makes up its list of committee nominations. At the election which follows the opening of the House, the nominees of the majority party always win. Since an agreement has already been reached as to the number of places on each committee the majority party is willing to concede the minority, the election of the standing committees is also exceedingly perfunctory. These standing committees or sub-legislatures dealing with particular fields of legislation are, perhaps one of the unique features of the American system.

All bills introduced into Congress are referred to the appropriate committee which has in fact almost life and death power over the proposals. Indeed, it is safe to assert that in the committees the real work of legislation is done. If and when a committee has finished with a bill it is reported out and placed upon the calendar. There are, however, entirely too many bills upon an ordinary Congressional calendar for

Congress to consider them all. Some sifting is imperative. The task of sifting the bills on the calendar is assigned to the Rules Committee, which has, if it cares to exercise it, almost complete control over the time of the House. Through the introduction of a special rule the Rules Committee can completely alter the course of business and bring up for consideration any measure on the calendar it sees fit. Actually much business is transacted through the technique of unanimous consent which is usually requested by the majority floor leader. If the measure is a financial one it is usually considered by the Committee of the Whole before being debated in Congress. Upon a final and favorable vote, the measure is signed by the Speaker, who sends it to the Senate where it goes through a similar routine.

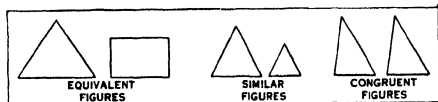
Several significant differences exist in the organization and procedure of the Senate. In the first place the Senate is presided over by the Vice-President of the United States who is a moderator to a much greater extent than the Speaker. In the second place no formal rules committee with arbitrary powers over the allotment of time exists in the Senate. The consideration of particular measures is much more a matter of mutual agreement. In the third place no rigid CLOSURE exists in the Senate. Except under very unusual circumstances the members of the Senate still retain their right to unlimited debate. In the event of a disagreement between the two houses a Conference Committee made up of members from each house is usually chosen in an endeavor to work out a compromise. If the Conference Committee effects a compromise to which the chambers agree and an identical bill passes both houses, the measure is signed by the presiding officer of each and then sent to the President for his approval. S. C. W.

CONGREVE, WILLIAM (1670-1729), English dramatist, was born at Bardsey, near Leeds, in Feb. 1670. He was educated at the University of Dublin and in 1691 went to London and entered the Middle Temple as a law student. Deciding to devote himself to literature, he wrote a novel of slight consequence and assisted JOHN DRYDEN in the translation of Juvenal and Vergil. Then came the first of his celebrated dramas, *The Old Bachelor*, produced in 1693 with instant and brilliant success. It was followed in rapid succession by two more comedies, *The Double Dealer* and *Love for Love*, the tragedy, *The Mourning Bride*, and in 1700 by another comedy, *The Way of the World*. At 30 and in less than 10 years Congreve had written five great plays of such quality that he had been called the greatest English comic dramatist. All except the last play were highly successful, but *The Way of the World*, although critics consider it the best of the five, met a cold reception. Thereupon Congreve declared he would write no more and afterward lived the life of a pleasure-seeking man-about-town. His plays are skilfully woven and have ingenious and intricate plots. But their renown rests chiefly on their sustained wit of dialogue and unceasing flow of epigram. By some they are deemed

licentious and repellant, qualities for which they were severely criticized in his own time. Congreve died in London, Jan. 19, 1729, and was buried in Westminster Abbey.

BIBLIOGRAPHY.—E. Gosse, *The Life of William Congreve*, new ed. 1924.

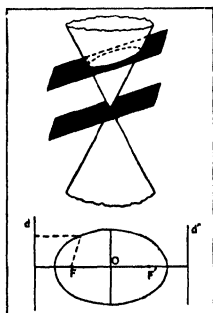
CONGRUENCE, a term applied to geometric figures which are identically equal; that is, which have the same shape and the same size. In the theory of numbers, if a number m divides the difference be-



DISTINCTION BETWEEN EQUIVALENT, SIMILAR AND CONGRUENT FIGURES

tween two numbers a and b , then a and b are said to be congruent with respect to the modulus m . If two figures have the same size, they are said to be equivalent; if they have the same shape, they are said to be similar.

CONICS, or Conic Sections, the curves along which a plane may cut a circular cone, right or oblique. A plane passing through the vertex of such a cone



PLANE PARALLEL TO THE PLANE THROUGH THE VERTEX CUTS THE CONE IN AN ELLIPSE

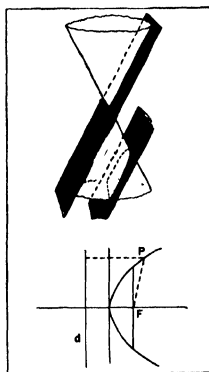
may (a) not contain any element of the cone; (b) contain one element and be tangent to the cone along this element; (c) contain two elements of the cone. A plane parallel to the plane in position (a) will cut all the elements of the same sheet of the cone and determine a closed curve, called an ellipse. A plane parallel to the plane in position (b) will cut the cone along an open curve, called a parabola. A plane parallel to the plane in position (c) will cut both sheets of the cone along a curve having two distinct branches,

—an hyperbola. If the plane in position (a) is parallel to the base of the cone, the secant plane parallel to it will cut the cone along a circle, which curve is therefore a special case of the ellipse and thus belongs to the class of conic sections.

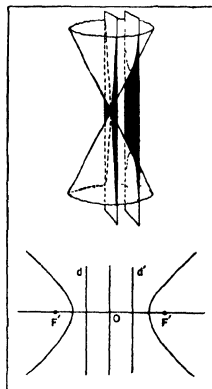
Conics may also be defined independently of the cone. The locus of a point which moves in the plane so that the ratio of its distance from a fixed point to its distance from a fixed line is constant is a conic. The fixed point is the focus of the conic, the fixed line is the directrix, and the constant ratio, usually denoted by e , is the eccentricity of the conic. The conic is an ellipse, a parabola, or an hyperbola according to whether e is less than, equal to, or greater than 1.

The perpendicular from the focus F upon the directrix d is the transverse axis of the conic. A point common to this axis and the conic is a vertex of the conic. The parabola has one vertex, whereas the ellipse and the hyperbola have two each. The mid-point O between the two vertices is the center of the ellipse or the hyperbola. These two curves have a second focus F' such that O is also the mid-point of FF' , and a corresponding directrix d' . The perpendicular to FF' at O is the conjugate axis of the conic.

Conics are often referred to as curves of the second degree, for when conics are studied by the methods of ANALYTIC GEOMETRY, their equations are of the second degree. Conic sections have been studied since ancient times (see APOLLONIUS). These curves are of paramount importance both in pure and in applied science. The paths described by the planets around the sun are ellipses, with the sun at one focus, while the paths of some of the comets are either hyperbolas or parabolas. Conics are extensively used by the engineer and the architect. See PROJECTIVE GEOMETRY.



PLANE THROUGH CONE PARALLEL TO A PLANE TANGENT TO THE CONE CUTS THE CONE ALONG A PARABOLA



THE PLANE, PARALLEL TO VERTICAL PLANE THROUGH VERTEX OF THE CONE CUTS ALONG AN HYPERBOLA

BIBLIOGRAPHY.—A more or less extensive theory of conics may be found in most books on Analytic Geometry and on Projective Geometry. Also in works like J. Hamlin Smith, *Geometrical Conics*, 1902; E. H. Askwith, *Pure Geometry*, 1921; W. C. Graustein, *Introduction to Higher Geometry*, 1930.

CONIFERS, in general the evergreen trees of the north temperate zone, but strictly, any cone-bearing tree, among the GYMNOSPERMS. As ordinarily understood by foresters and nurserymen, the conifers comprise all cone-bearing trees, most of which are evergreen, although the larch and the southern cypress are deciduous. Coniferous forests are the most important timber resources of the world, especially pines, spruce, the Douglas fir, California redwood and some of the cedars. Cones vary in size from those of the hemlock and the California redwood, which are less than three quarters of

an inch long, to some of our Rocky Mountain and Pacific coast pines where they may be 2 ft. long and $\frac{1}{2}$ ft. in thickness. Many conifers are widely cultivated for ornament, their handsome evergreen foliage, beautiful habit, and numerous horticultural varieties making them popular garden subjects. *See also* SEQUOIA; PINE; FIR; EVERGREEN. N. T.

CONJEEVERAM or **KUNCHIPURAM**, a sacred city in the Chingleput district of Madras, British India, on the South Indian railroad. This ancient city, formerly the seat of the Pallava dynasty, was captured by the Cholas, and later by the Mohammedans, from whom it was finally taken for the British by Clive in 1752. A noted place of Hindu pilgrimage, it contains the remarkably beautiful temples of Vishnu and Siva. Conjeeveram produces fine silk and cotton cloths. Pop. 1921, 61,376.

CONJUNCTION, in astronomy, the term applied when two celestial objects approach each other very closely in the sky, or, to be more precise, when their LONGITUDES are the same.

CONJUNCTIVITIS. *See* BLINDNESS, MEDICAL ASPECTS OF; EYE, AFFECTIONS OF.

CONJUNCTIVITIS, GRANULAR. *See* TRACHOMA.

CONJURING, the art of producing striking effects apparently suspending the laws of matter and mind, by ingenious use of skill and special devices or tricks. Legerdemain and sleight-of-hand are other names.

In the older sense, retained in the word magician, the conjurer was a sorcerer, a wonder worker through the possession of special powers. (*See* MAGIC.) Black magic was the use of such powers for working evil, in one reference by compact with the devil. White magic was beneficent and permissible. There can be no doubt that sorcerers utilized conjuring devices to impress the people. The Romans used concave mirrors and reflections to produce apparitions and arranged oracles by means of tubes and echoes. In India conjuring was developed to a fine art; amusements of similar nature formed part of the showman's bag of tricks in the Middle Ages.

The modern art may be said to begin with Robert Houdin, about 1850. He constructed ingenious automaton figures that gestured, played cards and answered questions, in some cases by concealing a person within the framework. He devised human figures apparently floating; a living figure from the waist up, apparently without legs; a vanishing lady or a person mysteriously suspended in mid-air, but actually supported by concealed wires or by resting the elbow on a rod, the performer wearing a rigid steel frame under the clothing. He used an electric current to heat a wire, which burnt a thread and released a false lid that made coins appear mysteriously in a transparent box.

But he developed equally the legerdemain side of what has since become a highly expert art. The fundamental trick is palming, or skilfully concealing objects in the hand, at the same time misdirecting the attention and by clever talk creating the atmos-

phere of an illusion. Next to palming is forcing a card upon the subject by a deft movement, while apparently the holder of the card is confident that he made a free selection. His own card then arises in the pack or appears in unexpected places.

False bottoms, concealed packets, hollow wands, substitution of the second of two like objects for the first, traps and a host of far more refined devices bring about the effect of the disappearance and re-appearance and transformation of objects. With the added resources of electric devices and radio and special devices kept as trade secrets within the profession, the possibilities of illusion are endless, and to the uninitiated the explanation as trickery seems incredible.

Conjuring combines mechanical devices with psychological effects. The psychology of deception has been ingeniously utilized in enhancing the mystery by baffling the audience and eliciting their participation. A standard performance is so-called mind reading, not MUSCLE READING, in which questions are answered and information of a personal nature disclosed. From duplicate impressions on wax tablets or substituted slips when questions are written, to transmission by concealed telephone; from codes of words in the talk between the performer in the audience and the mind reader on the stage to codes of gestures and memorized lists of clue words, the mind reader readily conveys the impression of possessing supernormal powers, while the use of confederates for especially dramatic effects is occasionally employed.

The professional conjuring of 1930 reached a refinement of performance as much above that of 1850 as the contrast between the position of physics and chemistry in the two periods. While the older forms of sleight-of-hand remain the basis of the art, the modern refinements, utilizing scientific advances, afford as unlimited a field for invention in the art of deception as in the constructive arts. J. J.

CONKLIN, EDWIN GRANT (1863-), American biologist, born in Waldo, O., Nov. 24, 1863. He received his B.S., A.B. and M.A. degrees from Ohio Wesleyan University, in 1885, 1886 and 1889 respectively, and his Ph.D. degree from Johns Hopkins in 1891. In 1891-94, he served at Ohio Wesleyan as a professor of biology, and, in 1894-96, at Northwestern University as a professor of zoology. He was also a professor of zoology at the University of Pennsylvania, 1896-98 and has been at Princeton in that capacity since 1908. He is co-editor of the *Biological Bulletin*, *Journal of Experimental Zoology* and *Genetics*. Among his best known books are *Heredity and Evolution*, *The Direction of Human Evolution*, *A Synopsis of General Morphology*, *The Future of Evolution*, *Revolt against Darwinism*, *Science and the Faith of the Modern*, *Embryology and Evolution*, *Problems of Development* and *Biology and Democracy*.

CONKLING, ROSCOE (1829-88), American political leader, was born at Albany, N.Y., Oct. 30, 1829. After attendance at the Mount Washington Colle-

giate Institute in New York City, he went to Utica in 1846 to study law. In 1850, the year of his admission to the bar, he was appointed district attorney of Albany Co. Originally a Whig, he was a Republican when he became mayor of Utica in 1858 and the same year was elected to the national House of Representatives. He served from 1859 to 1867 except for the term 1863-65. In Congress he zealously supported the Republican war measures and the later severe policy of reconstruction. He became a bitter enemy of James G. Blaine who in a verbal tilt referred to his "turkey-gobbler strut." William H. Seward's support of Andrew Johnson's reconstruction policy led to the rise of Roscoe Conkling as the leader of the New York State Republicans, as the radicals controlled a majority. Conkling was elected to the Senate in 1867 and reelected in 1873 and 1879. In 1873 he declined President Grant's proffered appointment as chief justice of the Supreme Court. In 1876 he was an unsuccessful candidate for the Republican presidential nomination.

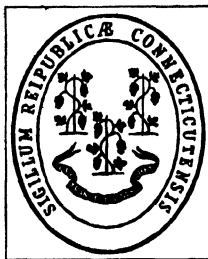
During Hayes's administration Conkling stoutly opposed the president's efforts to replace his New York party assistants, Chester A. Arthur and Alonzo B. Cornell, by other appointees to the New York Customs House. Hayes finally triumphed but the "Stalwarts" as Conkling's faction of the Republican party was called, amply rewarded the dismissed Arthur and Cornell, the first becoming vice-president of the United States and the latter governor of New York. The Stalwarts' opponents or "half-breeds" prevented the nomination of Grant, who was Conkling's choice, in the Convention of 1880. With President Garfield Conkling continued the quarrel as to the control of the New York Customs House. Garfield's appointees were confirmed in the Senate, whereupon Conkling and his colleague, Thomas C. Platt, in May 1881 resigned from the Senate, intending to be reelected by the New York legislature as a sign of approval of their senatorial conduct. Before the legislature met Garfield was shot, and public opinion being resentful of Conkling's previous attitude, both Conkling and Platt failed of reelection. He resumed his law practice in New York City, where he died, Apr. 18, 1888. S. McK.

CONNAUGHT, ARTHUR WILLIAM PATRICK ALBERT, DUKE OF (1850-), third son of Queen Victoria, was born at Buckingham Palace on May 1, 1850. His mother hoped he might follow a military career and named him for the Duke of Wellington. In 1866 he entered the Military Academy at Woolwich. Later he rose to the most important posts in the army, was commander of the Bombay army, 1886-90, commander-in-chief in Ireland, 1900-4, and in the Mediterranean, 1907. He served as governor-general of Canada, 1911-16. During the World War a Canadian regiment adopted the name of the duke's younger daughter, Patricia (b. 1886), popularly known as the Princess Pat. The latter gave up her title in 1919 to marry the Honorable Alexander Ramsay. The duke's son, Prince Arthur of Connaught

(b. 1883) was governor-general of the Union of South Africa, 1920-23.

CONNEAUT, a port city in the northeastern corner of Ohio, in Ashtabula Co., situated on Lake Erie, 70 mi. northeast of Cleveland. Lake steamers, bus and truck lines and three railroads afford transportation. There is an airport. Conneaut ships coal and iron extensively. It is a market center for fruit and truck crops grown in the vicinity. The local manufactures include shovels, tin cans, canned products, yarns, water softeners, leather and underwear. There is a large creamery. Moses Cleaveland, founder of Cleveland, visited this site in 1796. Conneaut was settled in 1800; incorporated as a village in 1834 and as a city in 1902. The city was originally called Salem. Pop. 1920, 9,343; 1930, 9,691.

CONNECTICUT, one of the original thirteen states of the Union and the southernmost of the New England group of states, popularly called the "Nutmeg State." It is situated between 40° 54' and 42° 3' N. lat. and 71° 47' and 73° 43' W. long. On the north it is bounded by Massachusetts, on the east by Rhode Island, on the south by Long Island Sound, and on the west by New York. Connecticut comprises an area of 4,965 sq. mi., including 145 sq. mi. of water surface. In size it ranks forty-sixth among the states of the Union.



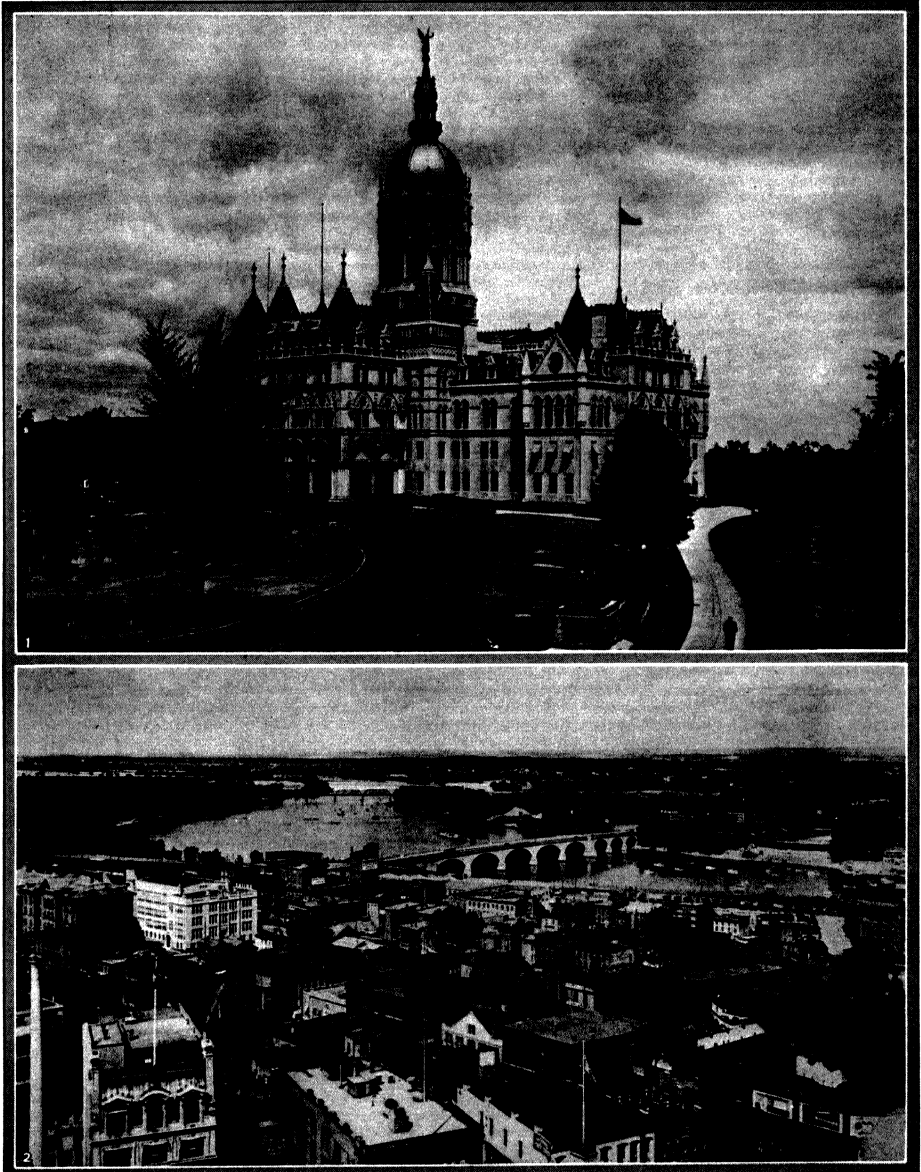
CONNECTICUT STATE SEAL

Surface Features. Connecticut is cut into two almost equal parts by the Connecticut River. Beginning at the northern border, each section has an area of highlands composed of worn-down mountain ridges which taper to low hills and disappear about two-thirds of the way through the state. The eastern highlands are a continuation of the New England Plateau; the western highlands form the terminal of the Green Mountains of Vermont. Bear Mountain, 2,355 ft., in the extreme northwest corner, is the highest altitude in the state. The mean elevation above sea level is 500 ft. Sloping southward throughout, the state carries its drainage streams, the Connecticut, Thames and Housatonic, to the Atlantic Ocean. It has 126 mi. of tidal coastline.

Between the highlands regions is the picturesque Connecticut Valley marked by long narrow ridges of traprock. Some notable examples are the East and West Rock at New Haven, the Hanging Hills near Meriden and the Talcott range west of Hartford. The valley is traversed by a trough of Triassic sediments belonging to the early part of the age of reptiles. Here have been found fossils and footprints of dinosaurs and other reptiles, as well as the remains of prehistoric plant life.

Climate. Geographically a small area with but slight contrasts in surface features, the climate of

CONNECTICUT

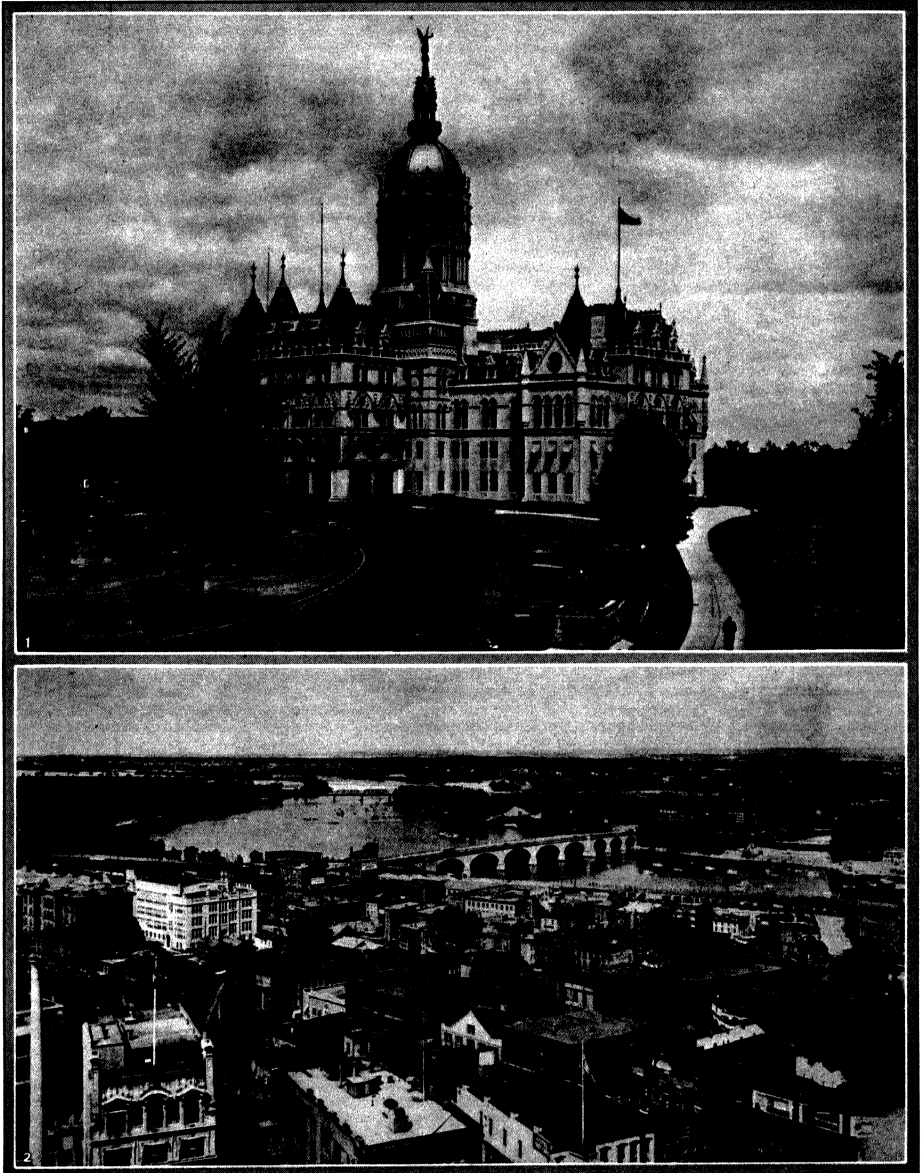


1. COURTESY CHAMBER OF COMMERCE, HARTFORD; 2. EWING GALLOWAY PHOTO

HARTFORD, CAPITAL OF CONNECTICUT

1. The State Capitol, built of white marble and completed in 1878. 2. View of the business section of the city with the Connecticut River, spanned by the nine-arched vehicular bridge, in the background.

CONNECTICUT



1. COURTESY CHAMBER OF COMMERCE, HARTFORD; 2. EWING GALLOWAY PHOTO

HARTFORD, CAPITAL OF CONNECTICUT

1. The State Capitol, built of white marble and completed in 1878. 2. View of the business section of the city with the Connecticut River, spanned by the nine-arched vehicular bridge, in the background.

CONNECTICUT

Area 4,965 sq. mi.
Pop. 1,606,003

PRINCIPAL CITIES

Pop.—Thousands

- 20 Ansonia . . . 1.9
- 5 Berlin . . . 1.2
- 4 Bethel . . . 1.4
- 3 Bloomfield D 13
- 3 Branford N 12
- 147 Bridgeport O 7
- 28 Bristol G 10
- 3 Cheshire J 11
- 3 Collinsville E 11
- 3 Cromwell H 14
- 22 Danbury L 3
- 4 Danielson E 24
- 7 Darien . . . 0.3
- 11 Derby M 8
- 3 E. Hampton I 16
- 17 East Hartford E 14
- 8 E. Haven N 11
- 3 East Lyme D 20
- 4 E. Norwalk L 4
- 4 E. Windsor L 3
- 13 Enfield . . . B 15
- 3 Essex . . . L 18
- 17 Fairfield H 9
- 5 Forestville G 11
- 6 Glastonbury W 15
- 3 Greenwich I 22
- 6 Greenwich R 1
- 4 Groton . . . L 22
- 19 Hamden E 11
- 164 Hartford E 14
- 9 Killingly D 24
- 22 Manchester E 16
- 3 Mansfield D 19
- 38 Meriden I 12
- 25 Middletown I 14
- 13 Milford . . . O 9
- 4 Montville K 21
- 4 Mossup F 24
- 6 Mystic . . . L 3
- 14 Naugatuck J 9
- 68 New Britain G 13
- 163 New Haven I 10
- 5 Newington I 13
- 30 New London I 21
- 5 New Milford L 21
- 4 Nook M 23
- 4 N. Haven L 11
- 36 Norwalk . . . P 4
- 23 Norwich G 21
- 6 Plainfield G 11
- 6 Plymouth G 9
- 4 Portland L 11
- 4 Preston . . . L 23
- 7 Putnam C 24
- 4 Ridgefield N 3
- 7 Rockville D 17
- 3 Salisbury . . . B 4
- 7 Seymour . . . L 8
- 10 Shelton M 8
- 4 Simsbury D 12
- 5 Southington E 11
- 10 South Manchester E 16
- 3 S. Windsor D 15
- 6 Stafford B 19
- 4 Stafford Springs B 18
- 46 Stamford . . . R 2
- 19 Stratford O 8
- 1 Suffield . . . B 14
- 6 Taftville H 22
- 4 Terryville G 9
- 4 Thomaston G 8
- 5 Thompson B 24
- 9 Thompsonville E 15
- 26 Torrington E 7
- 4 Trumbull N 7
- 5 Union City J 9
- 9 Vernon D 16
- 11 Wallingford E 11
- 100 Waterbury I 9
- 5 Waterford M 21
- 8 Watertown H 8
- 25 W. Hartford I 13
- 26 W. Haven N 10
- 6 Westport P 5
- 8 Wethersfield F 14
- 12 Willimantic F 20
- 9 Winchester C 7
- 14 Windham G 21
- 8 Windsor D 14
- 4 Windsor Locks L 14
- 8 Winsted . . . C 9



Connecticut is fairly uniform throughout. The annual mean temperature at Hartford is 48.5° F., ranging from a mean of 25.5° F. for January to 71.6° F. for July, with an average annual precipitation of 44.9 in. including 40.4 in. of snow. April 23 is the average date of the last killing frost in the spring at Hartford and October 13 that of the first killing frost in autumn, giving a growing season of 173 days.

Forests and Parks. Of a total land area of 3,084,800 acres, approximately 3,068,000 acres were originally forested, chiefly with chestnut, oak, white and yellow pines and hemlock. About 1,500,000 acres are forested but no virgin timber remains. A system of 15 state-owned forests varying from 130 acres to approximately 8,000 acres in extent and covering a total area of 59,483 acres in 1931 are to be increased to areas of 2,000 to 20,000 acres depending on the particular forest. Recreational development includes camping space with open fireplaces and firewood and over 100 mi. of hiking and horseback trails. The state has an active reforestation program and in 1930, 1,904,600 trees were set out on state and private lands and a total of 2,032 acres were reforested. One of the most interesting forests is the Peoples Forest created in 1924; it was given this name because it was purchased by popular funds subscribed in answer to the slogan "8 buys an acre." The first state park, the Israel Putnam Memorial Camp Ground, was established as early as 1887. Connecticut has 38 state parks with a total area in 1931 of 9,098 acres which have not been extensively developed for recreation. Camping is free for one or two nights; a charge is made for a longer period. The parks are open for winter sports. Devil's Hopyard Park contains the wildest ravine in southeastern Connecticut and five waterfalls; Hammonasset Beach has 2 mi. of unexcelled bathing beach and Macedonia Brook the largest park in the state offers splendid camp sites and trout fishing. Connecticut has four state monuments, Israel Putnam, John Mason, Nathan Hale, and Nathaniel Lyon, all of historical importance.

Minerals and Mining. The mineral resources of the state, consisting chiefly of clay deposits and quarries of building stone, are of relatively small importance. With mineral productions in 1929 amounting to \$7,053,468, Connecticut ranked thirty-ninth among the states. The principal products in order of value were basalt, \$2,924,085; clay products, \$2,038,539; granite, \$576,899; sand and gravel, 850,390 tons, \$566,410; lime, 35,180 tons, \$386,855; and limestone, \$155,261. During 1929 53 mines and quarries gave employment to 951 persons who received \$1,621,157 in salaries and wages.

Soil. Extensive areas in Connecticut are covered by a gravelly, glacial soil adapted only for grazing purposes and the growing of fruits. However, the valleys of the larger streams possess some rich alluvial deposits, notably the northern part of the Connecticut River valley where a highly fertile loam overlies a clay subsoil. The red lands, formed by

the decomposition of the underlying Triassic sandstones of the south central Connecticut valley, are especially suitable for peach growing. For the most part the coastal plain district is made up of sandy soils.

Agriculture. The chief farm products are tobacco, hay, vegetables and fruits.

In 1930 1,502,279 ac. or 48.7% of the entire land area was in farms, 17,195 in number, with an average size per farm of 87.4 ac. and an average value per acre of \$151.38. Of the farm area 430,588 ac. was crop land; 651,149 ac., pasture land; and 308,000 ac., woodland. The total value of farm property was \$260,268,642, of which \$227,412,905 was represented by land and buildings; \$12,370,693, by implements and machinery; and \$20,485,044, by domestic animals.

According to the census of 1930 Connecticut produced in 1929 field crops to the value of \$28,180,062, ranking forty-third among the states. Connecticut stood tenth in tobacco production with 26,225,827 lbs. grown on 19,115 ac. and valued at \$12,703,669. Other important crops were hay and forage, 326,189 tons, \$7,349,677; vegetables, \$5,340,442, including potatoes, \$2,023,301, and fruits, \$2,032,076. The chief fruits were apples 753,553 bu., peaches 140,020 bu., and strawberries 1,597,970 qts. Farm products sold by co-operative marketing rose from \$1,032,666 in 1919 to \$7,417,309 in 1929, and farm supplies purchased by this method from \$228,966 to \$2,531,429. Farm machinery and equipment in 1930 included 13,154 automobiles, 6,344 motor trucks, 2,667 tractors, 4,043 electric motors, and 5,462 stationary gas engines.

Animal Industry. Dairying and poultry growing are the chief animal industries. According to the census of 1930, Connecticut ranked forty-fifth among the states in total value, \$20,485,044, of domestic animals on farms. Among these were cattle, 166,654, valued at \$15,449,161; horses, 20,735, \$2,414,517; swine, 27,516, \$384,444, and sheep, 13,466, \$125,187.

Of the cows on farms, 110,987 were kept mainly for milk production and 1,846 mainly for beef production. In 1929, 64,137,369 gals. of milk were produced; the total value of dairy products marketed, mostly whole milk, was \$18,408,892. The total value of poultry raised, chiefly chickens, was \$5,442,407; the chickens sold were valued at \$2,779,586. Of 13,577,911 doz. chicken eggs produced, valued at \$6,392,411, 11,122,735 doz., with a value of \$5,237,344, were marketed.

Fisheries. In spite of its small size and, its importance as a manufacturing state, Connecticut stood eleventh among the states in 1930 in the value of its fisheries, the catch amounting to 54,878,000 lbs., valued at \$3,636,000. The most important species are cod, pollock, haddock, mackerel, weakfish, flounders, menhaden, swordfish, eels and clams and oysters. The lobster fishery is declining.

In 1930 the state issued 42,792 fishing licenses, and from the fees received, amounting to \$102,874, spent \$68,050 on fish propagation. Seven hatcheries em-

played 12 men and the output included 618,939 trout, 1,634 bass, 365,715 other game fish, and 206,163,000 commercial species. In addition, the United States Bureau of Fisheries planted 200,000 loch leven trout, 17,800 brook trout and 150 bass in Connecticut waters.

Transportation. Its coastal position assures Connecticut of communication with the Atlantic seaboard by water. The CONNECTICUT RIVER also is an important transportation artery. The Federal Government has made improvements in the river below Hartford, as well as in the harbors of Bridgeport and New Haven, which are ports of entry. New London, Stonington and Fairfield are also seaports. Several of these cities have lines affording a scheduled freight and passenger service by boat to New York City. Practically all of the 968 mi. of steam railways in the state in 1930 were controlled by the New Haven Railroad.

The highway system is undergoing considerable improvement and extension. On Jan. 1, 1930, there were 17,717 mi. of highways, of which 3,572 mi. were surfaced roads and 2,017 mi. state highways. The total highway expenditure during 1929 was \$16,100,572, of which the state paid \$12,751,248 and county and local governments \$3,349,324. The state gasoline tax produced a gross revenue of \$4,515,063 in 1930.

Motor vehicle registrations were 331,026 in 1930, compared with 250,669 in 1925. The growth of trucking facilities is indicated by a motor truck registration of 51,196 in 1930, as against 37,183 in 1925. Bus transportation nearly doubled during this period, 1,504 buses in operation in 1930 comparing with 867 in 1925.

Manufactures. Industrially the state is devoted almost wholly to manufacturing, which is highly diversified in character and includes several distinctive products. In colonial times Connecticut was noted for its iron, steel, brass and tin goods, and especially for its clocks and hats, which are still important products. Woolen mills were established in 1788 and cotton mills in 1804. Great impetus was given to the development of its factories by the War of 1812 and to a notable extent by the World War.

According to the Census of 1930 Connecticut with manufactures for 1929 valued at \$1,471,875,604 stood twelfth among the states. Its 3,129 establishments gave employment to 36,155 officers and employees, who received \$93,480,036 in salaries, and to 251,861 wage earners, who were paid \$328,865,412 in wages. These factories used a total of 909,239 horse power, expended \$32,363,508 for fuel and power, and \$633,297,808 for material and supplies, and added by the process of manufacture \$806,214,288 to the value of their output.

This output included more than 100 different products separately reported upon by the Census. The state stood preeminently first in brass and bronze manufactures, which, in value comprised nearly one-sixth of all its products. Among other manufactures in which Connecticut ranked first among the states were typewriters, clocks, hats, firearms and plated ware. The state stood second in machine tools and corsets, third in cutlery, fourth in silk and rayon and woolen goods, fifth in worsted goods, sixth in steam fittings, seventh in gas and electric fixtures and eighth in electrical machinery, apparatus and supplies.

The leading manufacturing industries, which produced about three-fifths of the total output of the state, in order of value were:

Industry or Product	No. Persons Employed	Value of Products \$
Brass and bronze products	25,327	224,229,776
Foundry and machine shop products	22,354	106,511,723
Electrical machinery	17,609	86,893,996
Hardware	21,258	71,231,720
Silk and rayon	11,187	54,298,469
Cotton goods	11,301	40,495,128
Hats, fur-felt	6,536	39,944,172
Machine tools	7,446	27,929,755
Printing and publishing, newspaper and periodical	4,504	27,911,577
Plated ware	6,074	27,903,210
Worsteds goods	4,167	27,890,179
Typewriters	9,410	25,406,203
Ammunition	3,528	22,519,731
Woolen goods	5,770	22,457,785
Engines and turbines	1,994	20,169,206

All the populous cities are manufacturing centers, of which the most important, according to value of output, were Bridgeport, \$176,258,794; Waterbury, \$157,587,994; Hartford, \$157,241,974, and New Haven, \$135,894,115.

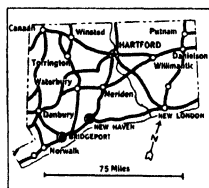
Commerce. According to the census of 1930, there were in 1929 1,369 wholesaling establishments in Connecticut, with total sales of \$520,550,666. These organizations gave full-time employment to 18,272 men and women, whose annual salaries aggregated \$28,098,521. The chief wholesaling centers are New Haven, Bridgeport and Hartford.

The total sales of the 22,065 retail stores amounted to \$764,571,044. Sales per store averaged \$34,651; sales per capita were \$475.80.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
Food	8,668	\$205,201,731	26.87
Automotive	3,172	135,374,102	17.71
General Mdse.	1,102	91,516,585	11.97
Apparel	2,198	75,220,505	9.84
Lumber & Bldg.	993	62,673,798	8.20
Furn. & Household	684	40,266,298	5.26
All other stores	5,248	154,318,025	20.15
Total, all stores	22,065	\$764,571,044	100.00

A greater part of the water-borne commerce of Connecticut is coastwise. New London, the principal port, handled a total amounting to 738,901 tons, with a value of \$250,643,867. New Haven, with com-



CONNECTICUT STATE ROADS

merce valued at \$153,360,866, and Bridgeport, with \$97,272,151, were also important.

Finance and Banking. The assessed value of all Connecticut property in 1929 was \$2,803,670,028. The total bonded debt on June 30, 1930 was \$16,291,100 against which there were sinking funds of \$14,965,411. Total revenue receipts for the year ended June 30, 1929 were \$36,950,436; total expenditures, \$34,445,874. Property and special taxes and licenses were the chief sources of revenue. Licenses included motor vehicle taxes and a sales tax on gasoline, which amounted to \$3,666,501 in 1929. The principal expenditures were for highways, \$14,600,249; permanent improvements \$14,212,099 and educational aid, \$1,751,776.

There were 244 banks in Connecticut in 1930, of which 61 were national banks, 179 trust companies and state banks and 4 private banks. Their aggregate capitalization was \$48,937,000; with surplus and undivided profits of \$155,275,000. Their total resources in 1930 were \$1,519,210,000; loans and discounts aggregated \$919,270,000. Demand and time deposits, including postal savings, totaled \$1,237,697,000. Per capita demand and time deposits were \$766.85; per capita savings deposits \$560.63. The total savings of \$904,854,000 were owned by 1,584,381 depositors.

Government. The legislative body consists of a general assembly composed of a senate of 35 members and a house of representatives of 258 members, all elected for terms of two years and meeting in biennial sessions of unlimited duration. The executive officers of the state are the governor, lieutenant governor, secretary, treasurer, and comptroller. The governor is elected for a term of two years and receives a salary of \$5,000 per annum. Judiciary power is vested in the court of errors, a superior court, court of common pleas, district, police and probate courts. The highest authority, the court of errors, consists of five judges chosen by the governor and the legislature for terms of eight years at salaries of \$8,000 per annum.

Social Welfare Institutions. The state has a farm for women at Niantic. The Long Lane Farm for girls is at Middletown and a school for boys at Meriden. At Mansfield is a training school for feeble-minded. At Norton Heights is Fitch's Home for the Soldiers and Soldiers' Hospital. State hospitals are at Middletown and Norwich, and tuberculosis sanitarium at Hartford, Meriden, Norwich, Shelton, and Niantic. Mystic has an oral school for the deaf. The state also supports a farm for inebriates and gives partial support to many other charitable institutions. A State Board of Charities supervises all charitable and penal institutions throughout the state, a number of which for the aged, insane, and children are run by private means. There are county homes for children and many towns support their own hospitals and almshouses. The penitentiary is at Wethersfield and a reformatory at Cheshire.

Education. The first school was opened in Hartford in 1639. This was followed soon after by a

school at New Haven. Laws passed by the Connecticut Colony in 1650 required every town of 50 families to appoint a teacher to instruct the children and every town of 100 families to set up a grammar school. Under the present law all children between the ages of 7 to 16 years are required to attend the full school year. In 1928-29 there were 1,243 public elementary schools with 8,065 teachers and 265,067 pupils and 90 high schools with 1,854 teachers and 45,483 pupils. Persons attending school from 5 to 20 years of age in 1930 numbered 353,540, or 72.4% of the population within the ages specified, as compared with 261,523, or 67.3% in 1920. The number of persons 10 years and over unable to read and write in 1930 was 59,874, or 4.5%; and in 1920, was 67,265, or 6.2%. Of the foreign-born whites, 10 years and over, there were 55,136, or 14.6%, illiterate in 1930; and 63,131, or 17%, in 1920.

The state conducts normal schools at New Britain, Willimantic, New Haven and Danbury, and 13 trade schools. Other institutions for higher education include Yale University at New Haven, Wesleyan University at Middletown, Trinity College at Hartford, the Connecticut Agricultural College at Storrs, Connecticut College for Women at New London, and the Hartford Theological Seminary. The Connecticut Public Library Committee has headquarters in the State Capitol at Hartford.

Population. In 1930 Connecticut ranked twenty-ninth among the states with a population of 1,606,903 or an average of 333.4 per square mile, an increase of 226,272 or 16.4% over 1920. The population rose from 237,946 in 1790 to 370,792 in 1850, 908,420 in 1900, 1,114,756 in 1910, and to 1,380,631 in 1920. In 1930 there were 1,576,673 or 98.1% whites and 29,354 or 1.8% Negroes. Of the whites, 1,193,802 were native born and 382,871 were foreign born. Of the total foreign stock, including foreign born, foreign and mixed parentage, 227,262 or 21.9% were Italian, 133,813 or 12.9% Polish, 128,742 or 12.4% from the Irish Free State. The urban population was 1,131,770 or 70.4% of the total, an increase of 195,431 or 20.9% over 1920; the rural population was 475,133 or 29.6% of the total, an increase of 30,841 or 6.9% since 1920. In 1930 there were five cities with a population of 50,000 and upwards; Hartford, 164,072; New Haven, 162,655; Bridgeport, 146,716; New Britain, 68,128; Waterbury, 99,902.

Occupations. In 1930 677,208 persons, or 42.1% of the population, were gainful workers 10 years old or older; 73.7% of these were males and 26.3% females; 66.2% were native white; 31.6% foreign-born white, and 2.1% Negro. Of the females 15 years old or older 67% were single, 23.1% were married and 9.9% were widowed or divorced.

Among the principal occupations, with number of workers, were factory operatives, 77,922 men and 48,308 women; clerks, 27,579 men and 20,417 women; factory laborers, 34,642 men and 3,502 women; farmers and farm wage workers, 34,346; salespersons, 19,367 men and 7,884 women; servants, 4,989 men

and 21,495 women; retail dealers, 23,965 men and 1,452 women; machinists, 16,261; carpenters, 15,869; chauffeurs, 14,802; school teachers, 2,058 men and 12,016 women; general building laborers, 13,455; bookkeepers and cashiers, 3,522 men and 8,523 women, and manufacturing foremen and overseers, 10,827.

HISTORY

Adriaen Block discovered and explored the Connecticut River, 1614; 19 years later the Dutch established a trading post at the site of Hartford, but the post and the fur trade soon fell into the hands of English colonists. Traders from Plymouth occupied the site of Windsor in 1633. Encouraged by the glowing reports of John Oldham, Massachusetts trader and explorer, residents of Cambridge, Dorchester, and Watertown emigrated to establish Wethersfield, 1634, Windsor, 1635, and Hartford, 1636. The celebrated Fundamental Orders, providing for a general court, the supreme civil authority, composed of deputies from the towns and a governor and magistrate elected by the freemen, was adopted in 1639. After the PEQUOT WAR had removed the Indian menace, Connecticut Colony prospered under its ecclesiastical leadership. New Haven was founded as a Puritan colony under John Davenport in 1637, and with the later settlements of Milford, Guilford, Stamford, Southold, and Branford composed one "jurisdiction," the New Haven Colony. In 1644 Connecticut Colony bought the title to Saybrook—a post at the mouth of the Connecticut, built in 1635 to forestall the Dutch—and the adjacent region from the proprietor, Lord Saye and Sele, beginning a policy of extending its domain by colonization or purchase. In 1662, urged by Gov. John Winthrop, Jr., Charles II granted Connecticut a charter which extended its boundaries to include the New Haven Colony. Hartford was the capital of the united colony, sharing that distinction with New Haven from 1701 until 1873. The charter, granting absolute autonomy, was jealously guarded, and was hidden in the famous Charter Oak, 1687-1689, when Sir Edmund Andros demanded its surrender.

The relations of Connecticut with the neighboring colonies were marked by almost incessant quarrels over boundaries and land rights. Religious influences were prominent in domestic policy; the Congregational church system was established in 1708, and secular and religious affairs were for generations controlled by the same authorities. Orthodoxy was assured by the rule, laid down in 1727, that only those were legal ministers who were so recognized by the general court; not until 1791 was the right of free incorporation granted to all sects. Connecticut took an aggressive part in the agitation leading to the REVOLUTIONARY WAR, and contributed over 30,000 men to the patriot army. Yet the burning of Danbury, 1777, the pillaging of New Haven, 1779, and the destruction of New London, 1781, by the British were almost the only engagements on Connecticut soil. Connecticut acquiesced in 1786 to the loss of its western land claims, retaining only the WESTERN RESERVE. In

the CONSTITUTIONAL CONVENTION of 1787 the delegates from Connecticut were responsible for the provision for state representation in the Senate and proportional representation in the House. In 1818 a new state constitution dissolved the alliance of church and state, and liberalized the franchise. Federalist even after that party was moribund elsewhere, generous in support of the Civil War, Connecticut was strongly Republican in party allegiance until 1878; but when party strength became more nearly balanced, an outworn system of representation, which revisions of the constitution have failed to remedy, on many occasions defeated the popular will. A Republican stronghold for many presidential elections, Connecticut in 1932 gave its eight electoral votes to Hoover. But Wilbur L. Cross, a Democrat outspokenly against prohibition, was reelected governor, and Augustine Lonergan, Democrat, was elected to the Senate.

BIBLIOGRAPHY.—G. L. Clark, *A History of Connecticut: its People and Institutions*, 1914; E. B. Sanford, *A History of Connecticut*, 1922.

CONNECTICUT COLLEGE FOR WOMEN, a privately endowed, non-sectarian institution at New London, Conn. Chartered under the title of Thames College, Apr. 4, 1911, the institution changed its name to Connecticut College for Women before it opened in 1915. The foundation of the college was due to the desire of the people of Connecticut to provide adequate facilities for the higher education of women within the limits of the state. Its establishment was further aided by the \$1,000,000 gift of its principal benefactor, Morton F. Plant. Laboratories are maintained for zoology, botany, chemistry, physics and home economics, and there is also a well-equipped observatory. The institution operates under an endowment fund which amounts to \$1,100,000. The library contains 34,055 volumes. In 1930 there were 540 students and a faculty of 59, headed by Pres. KATHERINE BLUNT.

CONNECTICUT RIVER, the largest river of New England, rising near the boundary line between Vermont and Canada at an altitude exceeding 2,000 ft. It flows southward, forming the boundary between Vermont and New Hampshire and continues in the same direction across Massachusetts and Connecticut to enter Long Island Sound at Saybrook. The tide reaches to Hartford, 50 mi. above its mouth. This river is 380 mi. long and has an average fall of 5 ft. per mile. It is navigable to Holyoke where a dam completely interrupts navigation. There are numerous falls and rapids at different points on the stream, chiefly those at Holyoke measuring 59 ft., at Bellows Falls 54.5 ft., and Turners Falls, 41 ft. Its chief tributaries are the Passumpsic, White, Deerfield, Westfield and Farmington rivers from the west; and the Ammonoosuc, Millers and Chicopee from the east. Besides those cities mentioned above, Middletown, Conn., Springfield and Northampton, Mass. and Brattleboro, Vt., are situated on its course.

The Connecticut drains an area of 11,345 sq. mi., the upper part of which is densely forested and the

lower section cleared and thickly settled. Its valley is celebrated for its beauty and fertility. It is throughout a lacustrine region and diversified by terraces, bluffs and broad expanses of alluvial land. Below the central part of Massachusetts the valley is composed of Triassic red sandstone in which are found footprints of extinct reptiles and birds.

CONNECTIVE TISSUE, the tissue of the body which binds together the various components and fills the spaces left in their interstices. In general, the intercellular material is more apparent and more important functionally than the cells.

Areolar tissue, the packing material of the body, is a loose mass of fibers of two kinds. White collagenous fibers (Fig. 1, *W.F.*) are thick and wavy. They give

Reticular tissue (Fig. 2) consists of very fine interweaving fibers forming the supporting framework of organs composed chiefly of loose cells, as the spleen, and lymph nodes.

Tendons, **LIGAMENTS**, fasciae, and aponeuroses are denser aggregations of the components of areolar tissue, especially of the white fibers. In these tissues the fibers tend to be uniformly oriented (Fig. 3).

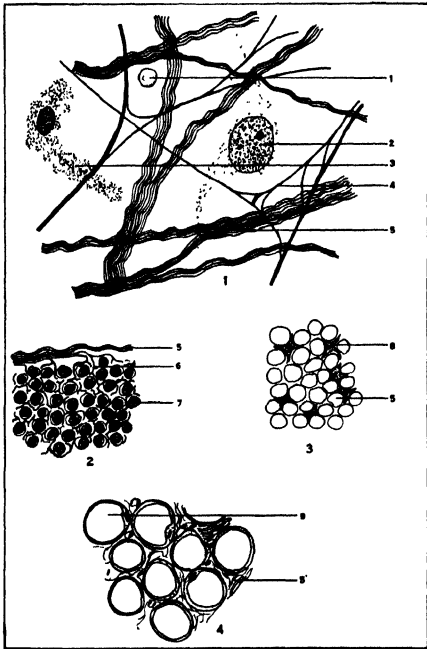
ADIPOSE TISSUE (Fig. 4) is connective tissue whose cells are specialized for the storage of fat. Each cell is transformed into a large vacuole of fat with a thin rim of cytoplasm. See also **BONE**; **CARTILAGE**; **HISTOLOGY**. W. J. S. K.

CONNELLVILLE, a city of Fayette Co., Pa., on Youghiogheny River, about 50 mi. southeast of Pittsburgh; it is served by the Baltimore and Ohio, Pennsylvania, Pittsburgh and Lake Erie, Pittsburgh and West Virginia, West Pennsylvania and Western Maryland railways and motor bus lines. Connellsville coal has excellent coking qualities, and this neighborhood supplies a large share of the coke produced in the United States. Coking and mining machinery, iron, electrical steel, mine pumps, wire glass, paving brick, flour, lumber, candy, silk and macaroni are among the manufactured products, whose aggregate in 1929 amounted approximately to \$2,800,000. The same year the retail trade amounted to \$7,800,387. The county's crops, consisting chiefly of corn, oats, hay, buckwheat, forage and tomatoes, amount to approximately \$4,000,000.

Connellsville was founded about 1773 by Zachariah Connell and incorporated in 1918. The whole region is rich in historical associations of Indian warfare and Revolutionary skirmishes. Washington's mill and Fort Necessity stand as landmarks. Pop. 1920, 13,804; 1930, 13,290; 10% foreign-born; 5% colored.

CONNEERSVILLE, a manufacturing city in eastern Indiana, the county seat of Fayette Co., situated on the White Water River, 57 mi. east of Indianapolis. It is served by the Baltimore and Ohio and the New York Central railroads. The principal local manufactures include automobiles, furniture, flour, paper, refrigerators, piston rings and carpet cleaners. The total value of manufactured products is about \$11,000,000 annually. Conneersville was incorporated 1813. Pop. 1920, 9,901; 1930, 12,705.

CONNOR, RALPH (1860-), Canadian writer, whose real name is Charles William Gordon, was born at Glengarry, Ont., Sept. 13, 1860. After graduating from Toronto University in 1863, he studied divinity at Knox College and took a post-graduate course at Edinburgh. From 1890-93 he did missionary work among the miners and lumbermen of the Canadian Rockies, and in 1894 became the pastor of St. Stephen's Presbyterian Church at Winnipeg. Under the pen name, Ralph Connor, Gordon wrote a number of successful books, including *Black Rock*, *The Sky Pilot*, *The Sky Pilot in No Man's Land*, and *The Runner*, 1929. Religious in tone, his work is informed with his varied experiences in Canada as missionary, pastor and chaplain.



TYPES OF CONNECTIVE TISSUE

Fig. 1, areolar connective tissue; Fig. 2, reticular connective tissue; Fig. 3, cross section of tendon; Fig. 4, adipose tissue

1 R.C., red blood cell; 2 Fib., fibroblasts; 3 His., histiocyte; 4 Y.F., yellow fiber; 5 W.F., white fiber; 6 R.F., reticular fibers; 7 Lym., lymphocyte; 8 T.C., tendon cell; 9 F.C., fat cell and its contained globule

toughness and tensile strength to the tissue. Yellow elastic fibers (*Y.F.*) are thin, regular, and branched. They add resiliency. Interspersed with the fibers are cells of various kinds. Fibroblasts (*Fib.*) are stellate cells, regular in outline, which form new tissue after injury. Histiocytes or clasmotocytes are stellate but with an irregular outline (*His.*), which aid in defending the body against invasion.

CONNOTATION, the meaning of a term or its intension, the opposite of denotation or definite extension of a term. Connotation has reference to the quality of a term, denotation to its quantity. The connotation of man may mean young, bright, and trustworthy men. These are attributes that the term connotes. The extent to which these attributes will be found in the class as a whole indicates their denotation. The attributes selected for purpose of classification form the connotative factor; the extent to which they will apply is the denotative factor. The more attributes selected the less will be the extension of the term. It would be possible to find more young men than men who are both young and bright. Add the quality of trustworthiness to these attributes and the group which will possess all three connotations is thereby made smaller. Connotation and denotation thus vary inversely with each other.

CONOY, an extinct Algonkian-speaking tribe closely related to the Nanticoke. The name seems to have been applied to various West Virginia and Maryland tribes. From what little is known of them it is apparent that they were hunters, and resembled closely other coastal Algonkin tribes.

CONQUEST, the acquisition of title to territory by forcible means. Conquest in a military sense is mere victory on the part of the fortunate and the acquiring state. In the legal sense, conquest is the means by which the victor begins the exercise of continuous and effective sovereignty over the conquered area. Mere military occupation does not vest complete and valid title in the victor. To make the title complete, the acquisition must be confirmed by a treaty of peace. If the whole state is conquered and annexed, no treaty is possible or necessary.

CONQUISTADORES, Spanish term for conquerors. It refers specifically to those Spaniards who in the 16th and 17th centuries ventured into the newly discovered world of the Americas to gain fame and fortune. Chief among them are the conquerors of Mexico and Peru, **HERNANDO CORTES** and **FRANCISCO PIZARRO**, respectively. Their extraordinary conquests, with the help of a few hundred of their countrymen, were due chiefly to the usual divisions among the peoples attacked, the terrorizing effect of horses and firearms in battle—innovations to the natives—and the crusading zeal with which the invaders pursued glory.

CONRAD, name of four German emperors and kings. Conrad I (d. Dec. 23, 918), grandson of the emperor Arnulf, was, after the extinction of the Carolingians, 911, elected East Frankish king by the Franks and Saxons. Conrad II (c. 990-1039) became king, 1024, upon the extinction of the Saxon line, and emperor in 1027. Conrad III (1093-1152) was crowned as rival to Lothair, in 1128, submitted to him, 1135, and, after the latter's death, 1138, was again elected king. He joined with Louis VII of France in the so-called Second Crusade. Conrad IV (1228-54), son of Emperor Frederick II, was elected German king in 1237, ruled with difficulty in Germany, went to Italy in 1251 and conquered Naples.

CONRAD, JOSEPH (1856-1924), Polish-English novelist, was born Joseph Korzeniowski, in the Ukraine, Dec. 6, 1856. His father, a literary man, was involved in the Polish uprising of 1863 and was banished to Velogda, but returned to Cracow where the boy spent his childhood. He read English literature in Polish translation, and Fenimore Cooper's *The Pilot* inspired him with a desire to go to sea. At 17 he left home and joined the French Merchant Service. In 1884, after six years' apprenticeship in English ships, he secured his master's certificate and took his first command to the East. *Youth*, 1902, one of his most beautiful tales of the sea, commemorates these early voyages. In 1889 Conrad began work on his first novel *Almayer's Folly*, and after its publication in 1895, gave up his ship and retired to Kent to write. His first books, *The Nigger of the Narcissus*, *Tales of Unrest*, *Lord Jim*, *An Outcast of the Islands*, *Typhoon* and *Nostromo* were enthusiastically acclaimed by people who appreciated Conrad's musical, vibrating prose and philosophical approach to the romantic life he had known. But it was not until he wrote his latter group, beginning with *The Secret Agent*, 1907, that he became generally popular. Among these later works are *Chance*, *The Shadow Line*, *The Arrow of Gold*, *The Rescue* and *The Rover*, which was unfinished. On several works he collaborated with Ford Madox Ford. Conrad wrote one play, *One Day More*, and dramatized *The Secret Agent*. Among modern novelists he ranks very high, and of all who have written of the sea Conrad is perhaps the greatest master. He died at Bishopbourne, Kent, Aug. 3, 1924.

BIBLIOGRAPHY.—G. J. Aubry, *Joseph Conrad, Life and Letters*, 1927; *Conrad to a Friend* (letters), ed. by Richard Curle, 1928; R. Curle, *The Last Twelve Years of Joseph Conrad*, 1928.

CONRIED, HEINRICH (1855-1909), theatrical manager, was born at Bielitz, Austria, Sept. 13, 1855. He became manager of the Bremen Opera in 1877. The following year he came to the United States, and in 1903 succeeded MAURICE GRAU as director of the Metropolitan Opera, New York, where he remained until 1908. Among the celebrated singers he retained for the company were ENRICO CARUSO, Feodor Chaliapin, OLIVE FREMSTAD, and GERALDINE FARRAR. His most notable production was *Parsifal*, first presented in 1903. Conried was decorated by the governments of Germany, Austria, Italy and Belgium for the excellence of his operatic productions by composers of the aforementioned nations. He died at Meran, Austria, Apr. 27, 1909.

CONSALVI, ERCOLE (1757-1824), celebrated cardinal and papal secretary, was born at Rome, June 8, 1757. He was educated at the Seminary of Frascati and at the Academia Ecclesiastica of Rome. In 1783 he was made chamberlain to Pope Pius VI, and for the next 15 years enjoyed many offices in the gift of the Church because of his knowledge of religious jurisprudence. When the French entered Rome, 1798, Consalvi was imprisoned, but later was

allowed to live in Venice. Here, after the death of Pius VI, he helped bring about the election of Pius VII, who in 1800 created him a cardinal and secretary of state. He concluded a concordat with Napoleon; later, on his opposing the latter's marriage with Marie Louise of Austria, he was ordered shot, but was finally exiled to Rheims. He died at Rome, Jan. 24, 1824.

CONSANGUINITY, the blood relationship of persons descending from the same ancestors. Its legal importance is great, for it is decisive in INHERITANCE matters, in determining next of kin, in permitting marriages which are never allowed in some cases, as brothers and sisters; the Roman Catholic Church required special permission between first cousins. Judges are disqualified from presiding, and jurors from acting, in cases of relationship with one of the litigants. The consanguinity of witnesses is taken into account in weighing the value of their testimony. *See also* MARRIAGE.

CONSCIENCE, the inner basis for judgments of right and wrong. It has been defined as "a still small voice within which tells us right from wrong." This definition expresses well the older attitude toward conscience. It was regarded as a relatively simple sense which could pass immediate and infallible judgments on right and wrong.

Comparative ethics has taught otherwise. Conscience is a most complex function, representing the sum total of native tendencies and dispositions, the habits and attitudes that have been built up and all the customs and social pressure that have been brought to bear upon the individual in influencing his judgment on moral questions.

CONSCIENCE, HENDRIK (1812-83), Belgian novelist, was born at Antwerp, Dec. 3, 1812. His first work, *In the Wonderful Year 1566*, published in 1837, won him immediate recognition in the new-formed Belgium, and his use of the Flemish language made him thereafter the hero of the Flemish Belgians in their opposition to things French. Conscience wrote over 100 romances and historical novels, and a history of Belgium. In 1845 he became professor at Ghent, and in 1868 was made director of the Wiertz Museum, Brussels. Conscience died at Brussels, Sept. 10, 1883.

CONSCIENCE WHIGS, those who deserted the WHIG PARTY in 1848 to join the FREE-SOIL PARTY, which espoused antislavery principles. As the nickname implied, they preferred to give up their traditional political allegiance rather than violate their moral sense. The term was used most widely in Massachusetts. *See* COTTON WHIGS.

CONSCIENTIOUS OBJECTOR, a term applied during the World War to persons who for religious, moral or humanitarian reasons declined, upon their enrollment under war legislation, to render service in a combatant branch of the Army or Navy, to render service in any branch, combatant or non-combatant, of the Army or Navy or to render alternative non-military service designed to further the national purpose of prosecuting the war.

CONSCRIPTION, a term connoting a national system of enrollment for military service, not only in time of war or national emergency but for recruitment and training in ordinary times to build up a trained reserve subject to the call of the government in time of emergency. It is based upon the principle of universal liability to military service. Orderly application of the principle found its inception toward the end of the 18th century, during the French Revolution, when voluntary enlistments failed to create and maintain French armies of sufficient strength available for extended service. The system under which successive classes of young men are called to the colors annually for training and subsequently passed to the reserve, subject to recall in time of war, was adopted by one great nation after another, until its application, except in Great Britain and the United States, had become general. Solely as a war-time measure, conscription was resorted to in Great Britain during the World War and in the United States during the Civil War and the World War. Elsewhere among great nations, except in Germany, required by the Treaty of Versailles to rely upon voluntary enlistment, conscript armies continue to be maintained. *See also* SELECTIVE SERVICE.

E. A. K.

BIBLIOGRAPHY—*Manual of Military Law*, The War Office, London, Upton's *Military Policy of the United States*.

CONSERVATION OF ENERGY. *See* ENERGY.

CONSERVATIVE, the name taken by the TOKY party in England after the Reform Act of 1832. During the next half century, the Conservatives held office only twice (1841-46, 1874-80) for any considerable length of time. But from 1886, when Gladstone's project of Home Rule for Ireland disrupted the Liberal party, they had the support of the seceding Liberal-Unionists and ruled for 15 of the next 20 years. Towards the end of this period they became seriously divided over the question of tariff reform (protection.) Their lack of solidarity showed itself in the conflict over the subordination of the House of Lords by the Parliament Act, 1911. The revival of the Liberal policy of Home Rule in 1912 gave them a common ground of opposition, however; the Conservatives fused with the Liberal-Unionists and were officially known as the Unionist party until after the setting up of the Irish Free State. They joined the COALITION governments during the World War. Restored to power by the election of Nov. 1922, they appealed to the country a year later on the issue of protection and suffered defeat. They abandoned protection and won a crushing victory over the Labor party in 1924, holding office for the next five years. In 1931 STANLEY BALDWIN, the leader, committed the party to protection once more and to some form of economic cooperation with the Dominions. In October of that year, the party won an overwhelming victory in the general election.

E. M. S.

CONSERVES, a name used for fruits preserved with sugar. They may be made of large or small fruits, or of several fruits combined, and often nuts are added. They are similar to marmalade in that

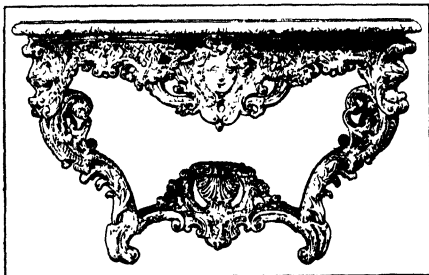
they are usually made of fruit which contains pectin and acid, and therefore produces a clear sparkling jelly in which slices or portions of fruit are held. They are cooked quickly with a large amount of sugar.

CONSHOHOCKEN, a borough in Montgomery Co., southeastern Pennsylvania, situated on the Schuylkill River, 16 mi. northwest of Philadelphia. Two railroads and buses afford transportation. There is an airport. Tires, steel products, tanks, glass, textiles and oils are the chief manufactures. The retail trade in 1929 amounted to \$3,101,327. Conshohocken was settled in 1820 and was incorporated in 1850. Matson's Ford in the river at Conshohocken was used by the Continental army during the American Revolution. Pop. 1920, 8,481; 1930, 10,815.

CONSIDÉRANT, VICTOR (1808-93), French Socialist, was born at Salins, Jura, Oct. 12, 1808. He was educated at the École Polytechnique. He sacrificed a promising engineering career to write for the Socialist organ of the Fourierists, *La Phalange*. Considérant founded the French cooperative movement and after Fourier's death became its leader. Among his writings are *Destinée sociale*, 1834, and *Socialisme devant le vieux monde*, published in 1849. In 1854 he founded a colony, La Réunion, at San Antonio, Texas, which failed to find supporters in sufficient number. Considérant died at Paris, Dec. 27, 1893.

CONSISTORY, an ecclesiastical term signifying, broadly, a bishop's court of jurisdiction. At Rome, a consistory may be public or private and is held for creating cardinals, canonization of saints and other purposes. The pope presides, cardinals are invited to attend, and on certain occasions bishops are added to their number.

CONSOLE, in architecture, a projection in the form of a single or double scroll, serving as a supporting bracket or merely as an ornament. In furniture, a console table or console is one that is fixed



COURTESY M. M. OF ART

FRENCH CONSOLE OF THE LOUIS XIV PERIOD

against a wall, often between windows under a pier glass, and supported in front by either consoles or legs, often elaborately carved in various shapes. The tops are usually of marble or mosaic, sometimes with fantastically curving edges. The console table was introduced in France under Louis XIV.

CONSOLIDATION, temporary defensive measures taken following the successful assault of a hostile position to cover the relief or reorganization of troops for continuation of the attack or pursuit. It consists of a hurried redistribution of troops to provide the greatest protection against enemy counterattacks which may be expected at this juncture. Principal dependence is placed on machine guns in consolidation.

CONSOLS, securities issued by the government of Great Britain. They bear no maturity date, but bear a fixed rate of interest. In 1751 nine government loans which were in the form of annuities, and comprised a large part of the public debt, were consolidated into a 3% annuity. This rate was reduced by conversion to 2 3/4% in 1888 and 2 1/2% in 1903. The fixed rate of interest is always maintained, and when the market justifies a higher rate, lenders are given a premium in the principal amount funded. The price of these annuities is an index to national credit.

CONSORTIUM, THE INTERNATIONAL (CHINESE), the international banking group formed in 1920 to promote closer co-operation in making loans to China. Considerable international jealousy had developed as a result of loans made to China by various powers during the latter part of the 19th and the beginning of the 20th centuries. After the World War, and particularly after Japan had made heavy loans to China in 1919 without adequate security or clear specification as to the purpose of the loans, some of the powers feared that further development of this sort might lead to the establishment of special and exclusive foreign economic or political influence in China. Prior to the war there had been joint action in floating certain Chinese loans. In 1920 a new Consortium was formed, including American, British, French, and Japanese banking groups. Each member agreed that it would give to all the others the opportunity to participate equally in any new loans it might arrange with China. The Chinese refuse to recognize the Consortium, and have floated no loans through it.

CONSPIRACY, an agreement between two or more persons to do an unlawful act, or to do a lawful act illegally. Some examples are: to act in RESTRAINT OF TRADE in order to control prices, to carry through a mock marriage for the purpose of seduction, and to obtain goods by concealing insolvency.

CONSPIRACY IN RESTRAINT OF TRADE, as defined by the SHERMAN ANTITRUST ACT of 1890, "every contract, combination or conspiracy which directly restrains trade." The CLAYTON ACT of 1914, which enlarged the Sherman Act, declares contracts with purchasers relating to the sale, lease or use of commodities and the fixing of prices in such a manner that purchasers shall not deal with competitors, where the effect of such arrangements is to lessen competition or create monopoly, is unlawful. Federal laws governing trade and commerce are effective only in interstate commerce and foreign trade and do not apply to local or intrastate business. See also ANTITRUST LEGISLATION.

CONSTABLE



"THE CORNFIELD, OR COUNTRY LANE"

By John Constable (1776-1837). In the National Gallery, London.

CONSTABLE, JOHN (1776-1837), English painter, was born at East Bergholt, Suffolk, England, June 11, 1776. He showed his love of art at an early age, but his father, a prosperous mill-owner, opposed his wish to study in London, until 1799 when Constable entered the Royal Academy. He struggled hard to master the technique of landscape painting, copying Claude Lorrain and the Dutch Masters and sketching from nature. His unique talent for depicting the English countryside was not fully fledged, however, until the decade 1816-26, when he produced his best works. By this time Constable was using divided tones of pure color and patches laid on with the palette knife to suggest the glitter of sunlight. But England was slow to recognize the revolutionary technique with which these quiet Suffolk landscapes were executed. It was not until *The Hay Wain*, now in the National Gallery, London, was exhibited in Paris in 1824 that Constable was recognized as the founder of the modern landscape school. He died at Hampstead, London, Mar. 31, 1837.

CONSTABLE, a title applied to a petty officer in some small towns and villages, who has a limited judicial power, and functions to conserve peace. The constable may also have additional duties given him by the community which he serves, such as tax-collector. The office was borrowed from England and was of much importance in colonial times.

CONSTABULARY, PHILIPPINE. See **PHILIPPINE SCOUTS**.

CONSTANCE, a city belonging to the German state of Baden, on Lake Constance, at the outflow of the Rhine from the lake. The old part of the town lies on the lake and the river. It was a free imperial city until 1548, then Austrian, and, since 1806, part of Baden. Of the buildings, the most notable is the cathedral, in Romanesque and late-Gothic style, begun in the 11th century. There are other churches and secular buildings of great antiquity and interest, as is the council hall in which Martin V was elected pope. Several other buildings are equally rich in historic associations. Pop. 1925, 31,252.

CONSTANCE, LAKE, (Bodensee), a large Swiss lake of the Alpine region. It lies on the outer margin of the Alps, forming the boundary between Germany and northeastern Switzerland, and on its southeastern shore touching Austria. It is of glacial origin and is drained by the Rhine River, which enters at the south and flows out at the west. Lake Constance is 1,309 ft. above sea level, over 40 mi. long, with a width of above 10 mi. and an area of more than 200 sq. mi. Its maximum depth reaches about 800 ft. At its northwestern extremity the lake forks into the Ueberlinger See and the Unter See. Fish and shellfish abound. Along its banks are situated Friedrichshafen, Stein-am-Rhein, Bregenz, Constance, Lindau, Ueberlingen, Arbon and Rorschach. Steamboat traffic is extensive, and is rarely impeded by ice in winter. Many beautiful relics of the Bronze Age have been found at Lake Constance, which is in the heart of a region inhabited by prehistoric lake dwellers.

CONSTANCE, PEACE OF. See **LOMBARD LEAGUE**.

CONSTANT, a quantity which remains unchanged in magnitude during the discussion of a given problem. A constant in one case may under other conditions become a **VARIABLE**. Absolute constants, such as a given number, never change in magnitude.

CONSTANTA (Constantza-Tomis), a Rumanian port in the province of Dobroudgea, on the Black Sea, of great importance in foreign trade. It has a nautical and other schools, banks, brisk industry and is the seat of a Greek Orthodox bishop. The harbor is always free from ice and is protected by a long dam. It has extensive and modern facilities for handling grain and petroleum. Nearby is the seashore resort Mamaia, with the royal summer palace. Pop. 1930, 58,258.

CONSTANT DE REBECQUE, HENRI BENJAMIN (1767-1830), French author and politician, was born at Lausanne, Switzerland, Oct. 25, 1767. After a cosmopolitan education, he settled in 1794 in Paris, where in 1799 he became a member of the Tribunal. He opposed the policies of Napoleon. His celebrated intimacy with **MADAME DE STAËL** began about 1795 and continued for a decade. After further travel, notably to Weimar, where he made the acquaintance of Goethe, Constant returned to Paris and liberal politics and again frequented Madame de Staël's salon; but he yielded to the influence of Mme. Récamier to support Napoleon, and with the accession of Louis XVIII in 1814 went into exile. He returned later, as writer, journalist and advocate of liberalism, and in 1830 became President of the Council of State. He published in 1815 an autobiographical, introspective novel, *Adolphe*, one of the first of its kind. Other works include a history of religion, 1825-31, and a number of political discourses. Constant died in Paris, Dec. 8, 1830.

CONSTANTINE (?-715), Pope, was a Syrian of whose birth and life very little is known. He was consecrated in 708, and is chiefly remembered for the part which he took in opposing the Emperor Justinian II, the patriarch of Constantinople and the decisions of the Trullan Council. In 709 by order of the Emperor he visited him at Constantinople, but declined to agree to the changes approved by the Greek Church, such as granting its independence of Rome and abolishing celibacy of the clergy. The Emperor Justinian II was the first to kiss the pontiff's foot. Constantine died at Rome on Apr. 9, 715.

CONSTANTINE I or CONSTANTINE THE GREAT (c. 286-337), Roman emperor was born at Naissus in upper Moesia (to-day Nish in Serbia), Feb. 27, c. 286 or 287. His father, Constantius I, raised to the rank of joint Augustus with Galerius, died in Britain in 306. The soldiers of Constantius immediately proclaimed Constantine Augustus but Constantine prudently rejected this high title and was content with the office of Caesar temporarily until he was able to consolidate his position. This process of consolidation was not indeed completed until 18

years had passed, in the course of which, after surviving six rivals, Constantine in 324 attained power as absolute ruler throughout the empire. The name of Constantine is associated with two events of much interest and importance, the first is the establishment of Christianity as the favored religion within the empire, and the second the establishment of Constantinople on the site of Byzantium as the new imperial capital. The emperor Galerius in 311 had already decreed the legal recognition of Christianity, but it remained for Constantine definitely to ally the state with that growingly influential institution the Christian Church. In 325 the first general council of the church was called by Constantine. It met at Nicaea primarily to deal with the Arian heresy which was troubling the peace of the state, but it also had important results in the formulation and definition of religious belief. In moving his capital to the Bosphorus, Constantine recognized the fact that the center of gravity of the empire had shifted from the west to the east. Founded in 320, Constantinople became the wealthiest and most populous city of the Middle Ages. Constantine also carried forward the reorganization of the civil and military establishment already begun by Diocletian. The expedient of the appointment of Augusti and Caesari quietly lapsed. Constantine associated with himself in the government his three sons and two nephews, attempting in this fashion to establish a dynasty to perpetuate control. For the old senatorial order he substituted court favorites whom he invested with titles and power, thus creating a new aristocracy to lend assistance to the imperial absolutism. In addition, Constantine separated the civil from the military administration and employed a veritable army of inspectors to check up and report on conditions throughout the empire. By this minute subdivision of power, he apparently sought to strengthen imperial central control and ensure permanency to his dynasty. All this necessarily included severe and oppressive taxation that gradually impoverished the empire and reduced the vast bulk of the population to a state of comparative serfdom, a condition that Constantine encouraged as being conducive to social conservatism and permanency. Constantine died at Ancyrona in Nicomedia, May 22, 337, after having left a lasting impress on Western civilization. His military reforms had two objectives: to maintain a relatively permanent force on the frontiers to meet the eruptions of barbarians from without, and to establish a mobile force which could move rapidly to put down internal disorder or aid a threatened point on the frontier.

CONSTANTINE XIII (1394-1453), last Byzantine Emperor, was born in 1394, the son of Emperor Manuel II. He ascended the throne in 1448 after the death of his brother John VIII. Constantine appealed in vain for European help against the Turks who by 1446 had captured practically all of the Byzantine empire. Constantinople fell before Mohammed II on May 29, 1453. In the final battle before the city gates, Constantine was killed.

CONSTANTINE I (1868-1923), King of Greece, son of George I of Greece and the Grand Duchess Olga Constantinova of Russia, was born at Athens, Aug. 2, 1868. He completed his military education in Germany and in 1889 married Princess Sophia Dorothea of Hohenzollern. At the outbreak of the World War, Constantine sympathized with Germany and attempted to maintain neutrality. Under pressure of the Allies he was forced to abdicate in June 1917. Returning in 1920 he was again forced to abdicate, Sept. 30, 1922. Constantine retired to Palermo, Sicily, and died there, Jan. 11, 1923.

CONSTANTINE, Africa, a fortified Algerian city situated on a tableland 2,130 ft. above the sea, in 36° 22' N. lat. and 6° 37' E. long. It is almost completely isolated, the ravine of the Rummel surrounding it on all but the western side. The El-Kantara Bridge, replacing an old Roman bridge, and four natural bridges cross it at various places. French influence has penetrated into one portion of the town and modernized it with broad, tree-shaded streets, fountains and open squares. The Moorish quarter, withheld from French ideas, is bizarre, constricted and filthy. The most notable buildings are the Roman citadel, mosques and the Palais de Justice. Educational institutions, both European and Arabic, have been established, the most prominent being a French government college and a Moslem theological seminary. PHILIPPEVILLE, which lies 54 mi. to the northeast by rail, is its seaport. A brisk trade with countries to the south in woollens, leather goods and grain is transported by caravans and railroads. Pop. 1926, 93,733.

CONSTANTINOPLE. See ISTANBUL.

CONSTANTINOPLE, COUNCILS OF. Three of the seven Ecumenical Councils of the undivided Church were held at Constantinople, and dealt with the Christological controversy. The first, 381, reaffirmed the decisions of the Council of Nicaea, 325, on the divinity of Christ. The second, in 553, again rejected the Nestorian heresy and proclaimed the doctrine of the one Person of Christ. The third Council of Constantinople, 680-681, condemned the Monothelite heresy, that Christ had but one will, and affirmed the reality of his human will as well as of his divine will.

The fourth Council of Constantinople, regarded by the Western Church as the eighth Ecumenical, was held in 869. It condemned Photius, who was restored by the Greeks in 879 at a synod in which they refused to recognize the Council of 869.

CONSTANTS, CHEMICAL. Supposed characteristic constants for liquids derived from integration of the CLAUSIUS-CLAPEYRON EQUATION expressed in the form

$$\frac{d \log_e p}{dT} = \frac{\Delta H}{RT^2}$$

if it is assumed that the dependence of ΔH on temperature is of the form

$\Delta H = A + BT + CT^2 + DT^3 \dots$ where A , B , C and D are constants for the liquid in question,

integration of the Clausius-Clapeyron Equation leads to $\log_e p = \frac{1}{R} \left(\frac{A}{T} + B \log_e T + CT + \frac{1}{2} DT^2 + \dots \right) + i$, where "i" is the constant of integration and should be characteristic of the liquid to which the equation for ΔH applies. The name "chemical constant" is applied, not to "i" itself but to $\left(\frac{i}{2.303} \right)$, the numerical factor entering in the conversion of $\log_e p$ to $\log_{10} p$. The term arose in connection with the Nernst Heat Theorem, the exceedingly important purpose of which was to make possible the calculation of chemical affinities from thermal data (latent and specific heats); in more general but less ambiguous terms, this theorem now usually finds expression in the Third Law of THERMODYNAMICS, a direct out-growth. While chemical constants have been computed for many substances, difficulties arise in the way of accuracy, due to the facts that the latent heat-temperature equation is a purely empirical one and that the range of temperatures possible for experimental observation with liquids is limited.

L. O. C.

CONSTANTS, PHYSICAL. In the measurement of physical quantities, there are certain numbers which stand out as important. Thus, in Newton's Law of universal gravitation, the force of attraction between two masses is given by the expression:

$$F = G \frac{M_1 M_2}{d^2}$$

where M_1 and M_2 are the masses under consideration and d is the distance between their centers; G is called the *gravitational constant* and is the force between unit masses when separated by unit distance: $G = 6.670 \times 10^{-8}$ dyne cm.² gr.⁻². It is a value in terms of which all gravitational forces may be expressed and, therefore, is important.

Millikan determined with precision the value of the elementary electrical charge, that unit of which all static charges and all electric currents are composed. Millikan found:

$$\begin{aligned} e &= 4.774 \times 10^{-10} \text{ electrostatic units} \\ &= 1.592 \times 10^{-19} \text{ coulombs} \\ &= 1.592 \times 10^{-20} \text{ electromagnetic units.} \end{aligned}$$

This constant value of the elementary charge is very important because, knowing it with precision, it is possible to fix, within the limits indicated below, the values of the following constants:

$$\begin{aligned} \text{Mass of the electron,} \\ m &= \text{about } 8.8 \times 10^{-28} \end{aligned}$$

$$\begin{aligned} \text{Avogadro constant,} \\ N &= (6.062 \pm 0.006) 10^{23} \end{aligned}$$

$$\begin{aligned} \text{Number of gas molecules,} \\ n &= (2.705 \pm 0.003) 10^{19} \end{aligned}$$

$$\begin{aligned} \text{Kinetic energy of translation of a molecule at} \\ 0^\circ \text{ C., } E_0 &= (5.621 \pm 0.006) 10^{-14} \end{aligned}$$

$$\begin{aligned} \text{Change of translational molecular energy,} \\ \epsilon &= (2.058 \pm 0.002) 10^{-10} \end{aligned}$$

$$\begin{aligned} \text{Mass of an atom of hydrogen,} \\ m &= (1.662 \pm 0.002) 10^{-24} \end{aligned}$$

Planck's element of action,

$$h = (6.547 \pm 0.013) 10^{-27}$$

Wien constant of spectral radiation,

$$C_2 = (1.4312 \pm 0.003)$$

Stefan-Boltzmann constant of total radiation,

$$\sigma = (5.72 \pm 0.034) 10^{-12}$$

Grating spacing in calcite,

$$d = (3.030 \pm 0.001 \text{ \AA.})$$

These values are taken from Millikan's book *The Electron*. These indicate in a concise way some of the important physical constants.

S. R. W.

CONSTELLATION, the arrangement of a number of stars into a group or figure. Constellation names are useful in designating or pointing out stars without ambiguity. Most of the constellations visible in northern latitudes were named by the ancients, in Mesopotamia and in Greece, who, considering the heavens as the stage where the gods performed, peopled the heavens with mythological figures of their imagination as well as with the animals they saw in daily life. The Constellations of the Zodiac, the Great Bear and Orion are probably very old; they are mentioned in the book of Job, and in Homer.

It should perhaps be stressed that the designations of the constellations are almost purely symbolic, as, for example, that of the Great Bear, a constellation that was considerably closer to the north pole in ancient times than it is now, and which was therefore most appropriately named after the animal which was known to inhabit only northern climes. In a few cases only is it easy to trace the resemblance to the figure or animal. The *Almagest* of Ptolemy contained 48 constellations which have survived to our times with but little change.

In the northern hemisphere a few groupings of faint stars were added as new constellations, while the region surrounding the south celestial pole, which was invisible to Ptolemy, was divided into a number of new constellations in the 17th and 18th century. Many of these southern constellations were named after scientific instruments, such as the telescope, the microscope, the octant and the compasses, or after animals and birds first seen on the discovery voyages to the Indies, as the bird of paradise, the chameleon and the flying fish. At present 88 constellations are recognized.

Up to a few years ago the boundaries between the constellations were largely a matter of individual taste, since they were only roughly indicated on the older star maps, a fact that caused much difficulty in the identification of variable stars which are named after the constellation in which they occur. The International Astronomical Union has now adopted a system of accurately defined boundaries, following meridians and parallels on the celestial sphere.

CONSTIPATION. The bowel should empty itself at least once a day. If a longer interval occurs, the resulting condition is termed constipation. If the situation is allowed to become chronic, the general state of health becomes lowered, the intellect dulled, and the appetite poor.

Among the causes of constipation are a diet deficient in foodstuffs leaving an indigestible residue, lack of exercise with the resultant weakening of the muscles of the abdominal wall and the loss of stimulation to intestinal movement accompanying bodily activity, neglect of the call of nature, old age, or abnormal conditions of the intestine, as atony, spasm, or excessive absorption in the colon.

Normally the food is in the digestive tract eighteen hours, of which all but five are spent in the large bowel. The delay may occur either in the colon or in the rectum. The proper cathartics and the addition of bulky foods to the diet will help relieve the former condition. In the latter condition, the stools are dry and hard. Cathartics have no effect on the rectum and enema must be resorted to.

The best general treatment for constipation is an abundance of exercise, the formation of regular bowel habits, and a diet containing such foods as bran, fresh vegetables, and fruit. Soap and water or glycerin enemata are efficient and harmless. In general, the fewer drugs used the better, as they usually increase the tendency to constipation. Certain of them, as mineral oil and cascara, do not have this effect. The treatment should, however, be directed toward the cause. See CATHARTICS.

CONSTITUTION. Constitutional Types. The constitution of the human being, or the total personality, is the sum of every attribute which composes the individual. These qualities can be roughly divided into four categories or panels, namely: the morphology or physical design; the physiology or function; the psychology; and the immunology or capacity of reaction with other living organisms such as bacteria or viruses.

The total personality is composed of two aspects. The first, called by some the "constitution proper," expresses the inherited, inherent, immutable qualities of the germ plasm, as for example, eye color. The second, often spoken of as "condition," represents the modifications which have been caused by the blows from environment. Among these might be mentioned malnutrition in infancy, destruction of the sex glands before puberty by mumps infection, with resulting growth disturbance, or a psychological injury arising perhaps from early fright or parental cruelty. Thus the completed individual presents a continually changing assemblage of total values, and consequently should be looked upon as the up-to-the-minute result of the combined action of heredity and environment.

It is necessary to divide mankind into groups, just as is done with all animal species, according to their several constitutions. There have been many classifications of man in the past, based on various of his multitudinous aspects. Thus there are separations into racial types determined chiefly by his stature, color and behavior. But it is interesting that throughout all races, two main types have always been recognized. These are the "long, thin" and the "short, thick." Intermediary expressions of these two, of

course, are frequently met, owing to crossing of the breeds.

Methods are now available for studying the characters in each of the panels of personality. Furthermore, by correlating the findings in each panel with those contained in the others, a surprisingly accurate presumption of a man's special disease potentialities may be reached. This knowledge is useful in diagnosis and prognosis. G.D.

Medical Aspects. The human body is a complicated collection of muscles, bones, nerves, blood vessels and organs composed of living cells. These tissues act upon fuel taken into the body and, through the circulating medium, known as the blood, develop secretions from glands and activities of individual structures. Hence it is impossible to consider an individual from the standpoint of any single organ, tissue, or system alone. He must be considered, instead, as the sum of all of these parts constantly acting and reacting upon one another and upon their environment.

This state of affairs for any individual constitutes what is known as his constitution. Because of his makeup he will tend to react toward certain situations in a definite way. This tendency is known as the individual disposition. The character of the person is also largely determined, not only by his physical state, but by heredity and environment. The constitution of the person is of the greatest importance to the physician in determining the manner in which the individual will react to disease or to various occurrences in human life.

Many authorities on the human constitution have tried to outline special types, based on the manner of reaction to physical and environmental conditions. Thus they classify as an arthritic type a person who tends to suffer from rheumatism and related diseases; tuberculous type; glandular types, one having special tendency to overactivity or underactivity of any of the glands of internal secretion; psychopathic type and cancerous type. In studying the likelihood of any individual toward the manifestations of various diseases, it is of the utmost importance to know whether or not he inclines toward any one of these special groups.

Few persons realize how definitely activity of various glands may mark the human body. Persons with excessive action of the thyroid gland may have abundant development of the hair of the body; hyperpigmentation of the skin; brilliant, constantly moving eyes, which in many instances are rather prominent; a warm, flushed skin with a tendency to excessive perspiration; not infrequently a rapid heart, and a high basal metabolism, indicating overactivity of chemical factors in the body.

On the contrary, one who is deficient in thyroid tends to be stolid, somewhat thick set and short; he tends to deposit excess amounts of fat on the body; the head is usually large; the neck short and thick; the hands short and stubby; the eyes small and not usually vivacious; the hair poorly developed about

the body. Such persons have a skin which is thick and fat and with little perspiration. Other glands of the body are associated, through underactivity or overactivity, with special appearances of the body form. This brief consideration is but an indication of an extensive field that modern medical science is entering.

M. F.

CONSTITUTION. The constitution of a government is the recognized setup of its working organization. A government's actual constitution is, therefore, always in first instance a matter of practice felt to be basic and right, not of the paper clauses which are often believed to be the constitution. In the United States, e.g., should presidential electors to-day follow the paper document and use discretion instead of being automatic rubber-stamps, they would be acting unconstitutionally. Again, one can search the document in vain for the most significant and peculiar feature of the American Constitution: viz., the power of judges to declare acts of either legislature or executive void, as being the violation of the written Constitution. Finally, let a doubter reread his written Constitution, with its meager enumerated powers, and reread that "the powers not delegated to the United States" are reserved to the States respectively, or to the people. Let him then look over such a description of the vast Federal government as the Beards' *American Leviathan*. No doubt can then remain that the United States Constitution, like all others, is in first instance a question of practice, not of paper. Thus the conventional distinction between unwritten constitutions (notably Great Britain) and "written constitution" (United States, France, Germany) turns rather on whether there is or is not one written document setting up a framework of permanent words which partly controls the greater framework of practice.

Such a document, where it exists, has great importance. It does not fix the working constitution; it does set lines of initial organization, the machinery, and in part even the direction of further growth. Thus the power expressly delegated to Congress "to regulate Commerce with foreign Nations, and among the several States" has thrown upon the nation rather than into an anarchy of competing states the bringing of some order into the whirling growth of a national transportation, marketing, and financial system. Again, and most importantly, the words of the writing of 1787 remain fixed (save for a few amendments) while population and territory expand, while the whole industrial and business structure of the country changes. Fixed words in an ancient document, plus the theory of merely delegated powers, plus a Supreme Court with power to test whether new legislation goes beyond the powers delegated or invades one of the express prohibitions—this combination makes for a slower growth of government to meet new problems than is useful (e.g. the difficulty of regulating public utilities); it favors the perpetuation of governmental institutions of dubious value; it forces some lines of growth into back-hand channels to keep them within striking distance of the language of the document

(e.g., the efforts to bring child labor under the clause about interstate commerce). On the other hand, the written document offers peculiar advantages in encouraging national unity in a rapidly expanding country. The written constitution is above party; it is the center of the national traditions, the symbol of unity. It is ancient enough to have become sacred. It forces a fair measure of stability into government, and yet has shown remarkable capacity for expanding.

A national constitution has three main problems to work out. One is the relation of government and the private individual or association living under it (*see BILL OF RIGHTS*). The second is organization of the government. The third is the relation between national government and local. In Montesquieu's classic theory, government was divided into three basic, separate powers: executive, law-making, and judicial. The United States Constitution which sought to accomplish this separation, obtained, in most instances, the happiest of results: e.g., independence of the judiciary from political control. The other two powers, however distinct at the extremes, give trouble when attempts are made to keep them wholly separate. In England, Parliament's control over the purse has led to responsibility of the executive (the Cabinet) to the legislative body. With the United States, too, not only is the political influence of individual legislators upon the course of administration important, but the technical difficulty of regulating the intricacies of modern business, plus the slowness of change in legislation, has forced a vast body of legislative work into executive hands. Any commission or department, given a governmental job to do, finds directions and limitations in the statutes of Congress or a state legislature; but thousands of decisions remain to be made about particular cases. Administrative regulations, law-making in character but made by the executive, result. Hardly less important is the influence of the executive (by presidential message or other means) on legislation. Nor is the necessary law-making function of the judges to be overlooked. Cases must be decided when they arise; and where the law is not definite, a judge must make it so. The effects of this real interlocking of powers are widespread; and the constitution is not an affair of single powers but an interlocking whole.

Of the division between national and local powers, only this can here be said: with the United States local powers are wider and more stubborn than in any other of the great countries. Legally, this is due to the theory of delegated powers; elsewhere it is the national government which, subject to Bills of Rights, holds all reserved powers. Politically, the United States' situation is due not only to the cumbersomeness of its amending system, but to the entrenched political machines to which state patronage means existence. But the system does afford two important advantages. There is wide room to adjust local government to differing local conditions, there is room within single states to experiment with all kinds of new legislation. Relative freedom of such experiment means discovery

of much that is valuable for the whole country. That such freedom means also freedom to make disastrous experiments only drives home again that no country can ever be "a government of laws and not of men," but only a government *partly* of laws, around which ill-chosen men will build ill practices or well-chosen men build wise ones.

K. N. L.
"CONSTITUTION," a United States frigate, known also as *Old Ironsides*. The vessel was one of six of its type built in Boston, Mass., from the plans of Joshua Humphreys, which carried 44 guns. Its length over all was 204 ft.; length on load water line, 175 ft.; beam, 43.6 ft.; mean draft, 22 ft.; armor, 21½ in. oak. It cost \$302,000 and its crew consisted of 475 men.

The vessel was launched in Oct. 1797, putting to sea in the summer of 1798, under command of Capt. Samuel Nicholson. From that time on, it became the most famous vessel in the American Navy. It won a race over a British frigate in 1800 and cut out the French privateer *Sandwich*. As Preble's flagship it took part in the war with Tripoli, 1801-05. In the War of 1812, under Isaac Hull, after a chase of three days, it escaped from a British squadron, in July 1812; destroyed the frigate *Guerniere*, Aug. 1812, in one of the most dramatic sea fights in history. Under Bainbridge, Dec. 29, 1812, it captured the frigate *Java*. In Feb. 1814, under Stewart, it captured the *Picton* with a convoy, and in Feb. 1812, the *Cyane* and *Levant*. The latter was recaptured by the British soon afterward.

In 1830 the *Constitution* was ordered dismantled as unseaworthy, but was saved by popular sentiment aroused by the poem, *Old Ironsides*, by OLIVER WENDELL HOLMES. In 1833 she was reconditioned and made many peace-time cruises in all parts of the world up to June 1855, when it went out of active service. Except for a brief period in 1878 when it crossed the Atlantic in its capacity of training ship, it had lain in Portsmouth and Boston navy yards. As the result of popular subscription and Congressional action, this vessel that successfully outlasted every fleet and every ship encountered, and in 40 battles never met defeat, was reconditioned and placed in commission in July 1931.

R. E. C.
CONSTITUTIONAL CONVENTION, an assembly of a body of elected representatives held to frame a new constitution or amendments to the existing one. The first instances occurred in New Hampshire and Massachusetts during the American Revolution, and it soon became a common practice to make provision in the state constitution for the calling of a constitutional convention. In more than half the states the legislature is now empowered to submit to the voters at any time the question of calling a convention; in seven states the question must be submitted periodically; and where the constitution is silent, it is assumed that the legislature may act without consulting the people. The Constitution of the United States was framed by a convention of delegates, appointed by the state legislatures, who sat at

Philadelphia in 1787. Article V provides that "on the application of the legislatures of two-thirds of the several states Congress shall call a convention for proposing amendments." In Europe the term "constituent assembly" is preferred; and most of the post-World War constitutions were enacted by such assemblies, specially elected for the purpose, but without that popular ratification which is required by the almost universal practice of the American states.

E. M. S.

CONSTITUTIONAL CONVENTION, THE, the assembly of delegates at Philadelphia, May 25-Sept. 17, 1787, which framed the CONSTITUTION OF THE UNITED STATES. Pursuant to the suggestion of the ANNAPOLIS CONVENTION, the Congress of the Confederation, on Jan. 21, 1787, called for a convention of delegates appointed by the several states to meet on May 14 "for the sole and express purpose of revising the Articles of Confederation." The delegates from Virginia and Pennsylvania, first to arrive, agreed informally that the existing compact (*see* CONFEDERATION, ARTICLES OF) should be superseded by a new, truly national constitution, and, when the convention was formally launched, succeeded in impressing their view upon the majority of delegates. A quorum—delegates from seven States—was not secured until May 25; by July 23 all the states except Rhode Island, which refused to respond to the call, were represented. George Washington was unanimously elected chairman. The convention was opened by Edmund Randolph, who submitted fifteen propositions for a strong, consolidated union. Charles Pinckney submitted an alternative draft, many provisions of which were incorporated in the final document. On May 30 the convention resolved itself into a committee of the whole to consider the 15 propositions *seriatim*. Two drafts emerged from these discussions, the "Virginia Plan" for a strongly centralized government, and the "Patterson Plan" which would have left the national Government without direct coercive powers over the individual citizens; the former represented the views of the large states, the latter of the small states. On July 16 the essential compromise was adopted which provided for representation by population in the House, and for equal representation of the states in the Senate. Other basic compromises prohibited the taxation of exports and otherwise allayed the fear of certain states that the national Government would use its powers of taxation oppressively, and permitted the importation of slaves until 1808. A Committee of Style, of which Gouverneur Morris was the leading member, gave the Constitution its final literary form. On Sept. 15 the epochal document was transmitted to the Congress.

BIBLIOGRAPHY.—A. C. McLaughlin, *The Confederation and the Constitution*, 1905; Max Farrand, editor, *The Records of the Constitutional Convention*, 1911; Max Farrand, *The Framing of the Constitution of the United States*, 1913.

CONSTITUTIONAL LIMITATIONS. The Constitution of the United States not only allocates the power of government to the constituent parts of

the Federal system but places definite and express limitations upon both the national and state governments. In so doing it creates a sphere of anarchy or civil liberty into which no government may intrude save only that authority which can change the Constitution. Chief among the constitutional limitations upon Congress are those relative to the passage of bills of attainder and Ex Post Facto Laws, the deprivation of any person of life, liberty or property without due process of law, and the further provisions contained in the first ten amendments. In addition to these specific limitations expressly set forth in the Constitution itself are certain others implied from the principles of governmental organization, chief among which is perhaps the prohibition of the delegation of legislative powers.

A similar series of limitations have been imposed upon the states. No state may pass a bill of attainder, or an ex post facto law, or confer a title of nobility. Nor may any state enter into any treaty or alliance without the consent of the Federal government, coin money, issue paper money or make anything but gold and silver. The maintenance of troops or ships of war in time of peace is likewise forbidden. Perhaps the most important constitutional limitations upon state action, however, are those relating to the impairment of a contract and the deprivation of any person of life, liberty or property without due process of law, or the denial to any person of the equal protection of the laws.

S. C. W.

BIBLIOGRAPHY.—W. B. Munro, *Government of the United States*, 1923.

CONSTITUTIONAL UNION PARTY, a minor political party which offered a presidential ticket, John Bell for president and Edward Everett for vice-president, in 1860. Its platform advocated "the constitution, the Union, and the enforcement of the laws," in effect a plea to ignore or suppress the slavery controversy, and appealed especially to the southern constituency of the old WHIG PARTY. Bell and Everett received 587,000 popular votes, securing 39 electoral votes by carrying Virginia, Kentucky and Tennessee.

CONSTITUTION AND GUERRIERE, two frigates which engaged in a combat Aug. 19, 1812, resulting in an American naval victory in the WAR OF 1812. The *Constitution*, with 58 guns, and under command of Capt. Hull, while cruising eastward of Nova Scotia encountered the British frigate *Guerriere*, with 48 guns, and under command of Capt. Dacres. For an hour the ships yawed and maneuvered, exchanging only a few shots, the *Constitution* pressing all sail to come alongside. When the vessels were within half pistol-shot of each other, Hull ordered a broadside. The battle became furious. The *Guerriere* lost its mizzenmast; its main yard was ribboned; its spars and hull were splintered. When the bowsprit of the *Guerriere* thrust across the *Constitution's* larboard quarter, both parties attempted to board, and engaged in musketry fight. The *Constitution* took advantage of a sudden fall wind to disengage, and the *Guerriere* was a hopeless wreck. The *Constitution* took favor-

able position for raking the British vessel; Dacres surrendered. The prisoners were brought off, and the *Guerriere* was set afire. The British loss in men was 78; the American, seven.

CONSTITUTION and JAVA, two warships which engaged in a combat Dec. 20, 1812, resulting in an American naval victory in the WAR OF 1812. The American frigate *Constitution*, with 45 guns, and commanded by Capt. Bainbridge, cruising southeast of San Salvador, Brazil, encountered the British frigate *Java*, with 49 guns and 446 men, and commanded by Capt. Lambert. Gen. Hyslop, governor of Bombay, and more than 100 passengers to the East Indies were on board the *Java*. The vessels engaged in a cannonade, which continued furiously for two hours; when the fire ceased nothing but the bare mizzenmast was left erect on the *Java*. The *Constitution* was much cut in sails and rigging, but had not lost a spar. The defeated frigate lost 65 men killed and 170 wounded; the loss on the *Constitution* was nine killed and 25 wounded. Afraid to trust his prize in a Brazilian port, Bainbridge, after the wounded and prisoners had been taken aboard the *Constitution*, set the *Java* afire.

CONSTITUTION OF THE UNITED STATES. The completed work of the CONSTITUTIONAL CONVENTION was transmitted by the Congress of the Confederation, Sept. 28, 1787, to the several states for ratification. Endorsed by the requisite number of states after a bitter struggle (see UNITED STATES, HISTORY OF: *Constitutions, State and National*), the notable document became in its own phrase, "the supreme law of the land." It has been amplified by the adoption of Amendments, and modified through interpretations of its phraseology and intent by the U.S. Supreme Court. No specific guarantees of civil liberties were included in the original document, because the framers believed that the federal courts would preserve the people from executive and legislative tyranny by interpreting the Constitution in the light of reason; but, to satisfy popular demand, there were added the 10 Amendments known as the "BILL OF RIGHTS." The 11th Amendment, in force Jan. 8, 1798, was an outcome of the case of CHISHOLM Vs. GEORGIA. The 12th, effective Sept. 25, 1804, was suggested by the confusion attending the presidential election of 1800. The intent of the 13th, effective Dec. 18, 1865, was to make practicable the emancipation of slaves in loyal states without compensating the owners. The 14th, effective July 28, 1866, and 15th, effective Mar. 30, 1870, were successive attempts to enforce the "Radical Republicans'" ideas of reconstruction. The 16th Amendment, in force Feb. 25, 1913, was designed to supersede a decision of the Supreme Court that a national income tax was unconstitutional. The 17th Amendment, changing the method of electing United States Senators, became effective May 31, 1913. The 18th and 19th Amendments are discussed under PROHIBITION and WOMAN SUFFRAGE, respectively.

A four-fold method of amending the new constitution was provided. Amendments might be initiated

by a two-thirds vote of both houses of Congress and ratified either by the state legislatures or by specifically called constitutional conventions in three-fourths of the states; or, on the application of the legislatures of two-thirds of the states, Congress was by Constitutional mandate obligated to call a constitutional convention for the purpose of proposing amendments. The convention's actions likewise are subject to the ratification of the state legislatures or specially called conventions in three-fourths of the states. Actually the method of Congressional initiative and legislative ratification is the only method which has ever been used.

Radical changes in the operation of the Federal government, other than those affected by the process of amendment, have nevertheless been made. They are for the most part the result of major legislative enactments, judicial interpretation, or the force of custom.

The text of the Constitution, with its Amendments, follows:

THE CONSTITUTION

PREAMBLE.

We, the people of the United States, in order to form a more perfect Union, establish justice, insure domestic tranquillity, provide for the common defence, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity, do ordain and establish this CONSTITUTION for the United States of America.

ARTICLE I.

Section 1

All legislative powers herein granted shall be vested in a Congress of the United States, which shall consist of a Senate and House of Representatives.

Section 2

1. The House of Representatives shall be composed of members chosen every second year by the people of the several States, and the electors in each State shall have the qualifications requisite for electors of the most numerous branch of the State Legislature.

2. No person shall be a Representative who shall not have attained to the age of twenty-five years and been seven years a citizen of the United States, and who shall not, when elected, be an inhabitant of that State in which he shall be chosen.

3. Representatives and direct taxes shall be apportioned among the several States which may be included within this Union according to their respective numbers, which shall be determined by adding to the whole number of free persons, including those bound to service for a term of years, and excluding Indians not taxed, three-fifths of all other persons. The actual enumeration shall be made within three years after the first meeting of the Congress of the United States, and within every subsequent term of ten years, in such manner as they shall by law direct.

The number of Representatives shall not exceed one for every thirty thousand, but each State shall have at least one Representative; and until such enumeration shall be made, the State of New Hampshire shall be entitled to choose 3; Massachusetts, 8; Rhode Island and Providence Plantations, 1; Connecticut, 5; New York, 6; New Jersey, 4; Pennsylvania, 8; Delaware, 1; Maryland, 6; Virginia, 10; North Carolina, 5; South Carolina, 5, and Georgia, 3.*

4. When vacancies happen in the representation from any State, the Executive Authority thereof shall issue writs of election to fill such vacancies.

5. The House of Representatives shall choose their Speaker and other officers, and shall have the sole power of impeachment.

Section 3

1. The Senate of the United States shall be composed of two Senators from each State, chosen by the Legislature thereof, for six years; and each Senator shall have one vote.

2. Immediately after they shall be assembled in consequence of the first election, they shall be divided as equally as may be into three classes. The seats of the Senators of the first class shall be vacated at the expiration of the second year, of the second class at the expiration of the fourth year, and of the third class at the expiration of the sixth year, so that one-third may be chosen every second year; and if vacancies happen by resignation, or otherwise, during the recess of the Legislature of any State, the Executive thereof may make temporary appointment until the next meeting of the Legislature, which shall then fill such vacancies.

3. No person shall be a Senator who shall not have attained to the age of thirty years, and been nine years a citizen of the United States, and who shall not, when elected, be an inhabitant of that State for which he shall be chosen.

4. The Vice President of the United States shall be President of the Senate, but shall have no vote unless they be equally divided.

5. The Senate shall choose their other officers, and also a President pro tempore, in the absence of the Vice President, or when he shall exercise the office of President of the United States.

6. The Senate shall have the sole power to try all impeachments. When sitting for that purpose, they shall be on oath or affirmation. When the President of the United States is tried, the Chief Justice shall preside; and no person shall be convicted without the concurrence of two-thirds of the members present.

7. Judgment of cases of impeachment shall not extend further than to removal from office, and disqualification to hold and enjoy any office of honor, trust, or profit under the United States; but the party convicted shall nevertheless be liable and subject to indictment, trial, judgment, and punishment, according to law.

* See Article XIV., Amendments.

Section 4

1. The times, places, and manner of holding elections for Senators and Representatives shall be prescribed in each State by the Legislature thereof; but the Congress may at any time by law make or alter such regulations, except as to places of choosing Senators.

2. The Congress shall assemble at least once in every year, and such meeting shall be on the first Monday in December, unless they shall by law appoint a different day.

Section 5

1. Each House shall be the judge of the elections, returns, and qualifications of its own members, and a majority of each shall constitute a quorum to do business; but a smaller number may adjourn from day to day, and may be authorized to compel the attendance of absent members in such manner and under such penalties as each House may provide.

2. Each House may determine the rules of its proceedings, punish its members for disorderly behavior, and with the concurrence of two-thirds expel a member.

3. Each House shall keep a journal of its proceedings, and from time to time publish the same, excepting such parts as may in their judgment require secrecy; and the yeas and nays of the members of either House on any question shall, at the desire of one-fifth of those present, be entered on the journal.

4. Neither House, during the session of Congress shall, without the consent of the other, adjourn for more than three days, nor to any other place than that in which the two Houses shall be sitting.

Section 6

1. The Senators and Representatives shall receive a compensation for their services to be ascertained by law, and paid out of the Treasury of the United States. They shall in all cases, except treason, felony, and breach of the peace, be privileged from arrest during their attendance at the session of their respective Houses, and in going to and returning from the same; and for any speech or debate in either House they shall not be questioned in any other place.

2. No Senator or Representative shall, during the time for which he was elected, be appointed to any civil office under the authority of the United States which shall have been created, or the emoluments whereof shall have been increased during such time; and no person holding any office under the United States shall be a member of either House during his continuance in office.

Section 7

1. All bills for raising revenue shall originate in the House of Representatives, but the Senate may propose or concur with amendments, as on other bills.

2. Every bill which shall have passed the House of Representatives and the Senate shall, before it becomes a law, be presented to the President of the

United States; if he approves, he shall sign it, but if not, he shall return it, with his objections, to that House in which it shall have originated, who shall enter the objections at large on their journal, and proceed to reconsider it. If after such reconsideration two-thirds of that House shall agree to pass the bill, it shall be sent, together with the objections, to the other House, by which it shall likewise be reconsidered; and if approved by two-thirds of that House it shall become a law. But in all such cases the votes of both Houses shall be determined by yeas and nays, and the names of the persons voting for and against the bill shall be entered on the journal of each House respectively. If any bill shall not be returned by the President within ten days (Sundays excepted) after it shall have been presented to him, the same shall be a law in like manner as if he had signed it, unless the Congress by their adjournment prevent its return; in which case it shall not be a law.

3. Every order, resolution, or vote to which the concurrence of the Senate and House of Representatives may be necessary (except on a question of adjournment) shall be presented to the President of the United States; and before the same shall take effect shall be approved by him, or being disapproved by him, shall be repassed by two-thirds of the Senate and the House of Representatives, according to the rules and limitations prescribed in the case of a bill.

Section 8

1. The Congress shall have power:

To lay and collect taxes, duties, imposts, and excises, to pay the debts and provide for the common defence and general welfare of the United States; but all duties, imposts, and excises shall be uniform throughout the United States.

2. To borrow money on the credit of the United States.

3. To regulate commerce with foreign nations, and among the several States, and with the Indian tribes.

4. To establish a uniform rule of naturalization and uniform laws on the subject of bankruptcies throughout the United States.

5. To coin money, regulate the value thereof, and of foreign coin, and fix the standard of weights and measures.

6. To provide for the punishment of counterfeiting the securities and current coin of the United States.

7. To establish post-offices and post-roads.

8. To promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive rights to their respective writings and discoveries.

9. To constitute tribunals inferior to the Supreme Court.

10. To define and punish piracies and felonies committed on the high seas, and offences against the law of nations.

11. To declare war, grant letters of marque and reprisal, and make rules concerning captures on land and water.

CONSTITUTION OF THE UNITED STATES

12. To raise and support armies, but no appropriation of money to that use shall be for a longer term than two years.

13. To provide and maintain a navy.

14. To make rules for the government and regulation of the land and naval forces.

15. To provide for calling forth the militia to execute the laws of the Union, suppress insurrections, and repel invasions.

16. To provide for organizing, arming, and disciplining the militia, and for governing such part of them as may be employed in the service of the United States, reserving to the States respectively the appointment of the officers, and the authority of training the militia according to the discipline prescribed by Congress.

17. To exercise exclusive legislation in all cases whatsoever over such district (not exceeding ten miles square) as may, by cession of particular States and the acceptance of Congress, become the seat of Government of the United States, and to exercise like authority over all places purchased by the consent of the Legislature of the State in which the same shall be, for the erection of forts, magazines, arsenals, dry-docks, and other needful buildings.

18. To make all laws which shall be necessary and proper for carrying into execution the foregoing powers and all other powers vested by this Constitution in the Government of the United States, or in any department or officer thereof.

Section 9

1. The migration or importation of such persons as any of the States now existing shall think proper to admit shall not be prohibited by the Congress prior to the year one thousand eight hundred and eight, but a tax or duty may be imposed on such importation, not exceeding ten dollars for each person.

2. The privilege of the writ of habeas corpus shall not be suspended, unless when in cases of rebellion or invasion the public safety may require it.

3. No bill of attainder or ex post facto law shall be passed.

4. No capitation or other direct tax shall be laid, unless in proportion to the census or enumeration hereinbefore directed to be taken.

5. No tax or duty shall be laid on articles exported from any State.

6. No preference shall be given by any regulation of commerce or revenue to the ports of one State over those of another, nor shall vessels bound to or from one State be obliged to enter, clear, or pay duties in another.

7. No money shall be drawn from the Treasury but in consequence of appropriations made by law; and a regular statement and account of the receipts and expenditures of all public money shall be published from time to time.

8. No title of nobility shall be granted by the United States. And no person holding any office of profit or trust under them shall, without the consent

of the Congress, accept of any present, emolument, office, or title of any kind whatever from any king, prince, or foreign state.

Section 10

1. No State shall enter into any treaty, alliance, or confederation, grant letters of marque and reprisal, coin money, emit bills of credit, make anything but gold and silver coin a tender in payment of debts, pass any bill of attainder, ex post facto law, or law impairing the obligation of contracts, or grant any title of nobility.

2. No State shall, without the consent of the Congress, lay any impost or duties on imports or exports, except what may be absolutely necessary for executing its inspection laws, and the net produce of all duties and imposts, laid by any State on imports or exports, shall be for the use of the Treasury of the United States; and all such laws shall be subject to the revision and control of the Congress.

3. No State shall, without the consent of Congress, lay any duty of tonnage, keep troops or ships of war in time of peace, enter into agreement or compact with another State, or with a foreign power, or engage in war, unless actually invaded, or in such imminent danger as will not admit of delay.

ARTICLE II.

Section 1

1. The Executive power shall be vested in a President of the United States of America. He shall hold his office during the term of four years, and, together with the Vice-President, chosen for the same term, be elected as follows:

2. Each State shall appoint, in such manner as the Legislature thereof may direct, a number of electors equal to the whole number of Senators and Representatives to which the State may be entitled in the Congress; but no Senator or Representative or person holding an office of trust or profit under the United States shall be appointed an elector.

3. The electors shall meet in their respective States and vote by ballot for two persons, of whom one at least shall not be an inhabitant of the same State with themselves. And they shall make a list of all the persons voted for, and of the number of votes for each, which list they shall sign and certify and transmit, sealed, to the seat of the Government of the United States, directed to the President of the Senate. The President of the Senate shall, in the presence of the Senate and House of Representatives, open all the certificates, and the votes shall then be counted. The person having the greatest number of votes shall be the President, if such number be a majority of the whole number of electors appointed, and if there be more than one who have such a majority, and have an equal number of votes, then the House of Representatives shall immediately choose by ballot one of them for President; and if no person have a majority,

then from the five highest on the list the said House shall in like manner choose the President. But in choosing the President, the vote shall be taken by States, the representation from each State having one vote. A quorum, for this purpose, shall consist of a member or members from two-thirds of the States, and a majority of all the States shall be necessary to a choice. In every case, after the choice of the President, the person having the greatest number of votes of the electors shall be the Vice President. But if there should remain two or more who have equal votes, the Senate shall choose from them by ballot the Vice President.*

4. The Congress may determine the time of choosing the electors and the day on which they shall give their votes, which day shall be the same throughout the United States.

5. No person except a natural born citizen, or a citizen of the United States, at the time of the adoption of this Constitution, shall be eligible to the office of President; neither shall any person be eligible to that office who shall not have attained to the age of thirty-five years and been fourteen years a resident within the United States.

6. In case of the removal of the President from office, or of his death, resignation, or inability to discharge the powers and duties of the said office, the same shall devolve on the Vice President, and the Congress may by law provide for the case of removal, death, resignation, or inability, both of the President and Vice President, declaring what officer shall then act as President, and such officer shall act accordingly until the disability be removed or a President shall be elected.

7. The President shall, at stated times, receive for his services a compensation which shall neither be increased nor diminished during the period for which he shall have been elected, and he shall not receive within that period any other emolument from the United States, or any of them.

8. Before he enter on the execution of his office he shall take the following oath of affirmation:

"I do solemnly swear (or affirm) that I will faithfully execute the office of President of the United States, and will, to the best of my ability, preserve, protect, and defend the Constitution of the United States."

Section 2

1. The President shall be Commander-in-Chief of the Army and Navy of the United States, and of the militia of the several States when called into the actual service of the United States; he may require the opinion, in writing, of the principal officer in each of the executive departments upon any subject relating to the duties of their respective offices, and he shall have power to grant reprieves and pardons for offences against the United States except in cases of impeachment.

2. He shall have power, by and with the advice

* This clause is superseded by Article XII., Amendments.

and consent of the Senate to make treaties, provided two-thirds of the Senators present concur; and he shall nominate and by and with the advice and consent of the Senate shall appoint ambassadors, other public ministers and consuls, judges of the Supreme Court, and all other officers of the United States whose appointments are not herein otherwise provided for, and which shall be established by law; but the Congress may by law vest the appointment of such inferior officers as they think proper in the President alone, in the courts of law, or in the heads of departments.

3. The President shall have power to fill up all vacancies that may happen during the recess of the Senate by granting commissions, which shall expire at the end of their next session.

Section 3

He shall from time to time give to the Congress information of the state of the Union, and recommend to their consideration such measures as he shall judge necessary and expedient; he may, on extraordinary occasions, convene both Houses, or either of them, and in case of disagreement between them with respect to the time of adjournment, he may adjourn them to such time as he shall think proper; he shall receive ambassadors and other public ministers; he shall take care that the laws be faithfully executed, and shall commission all the officers of the United States

Section 4

The President, Vice-President, and all civil officers of the United States shall be removed from office on impeachment for and conviction of treason, bribery or other high crimes and misdemeanors.

ARTICLE III.

Section 1

The judicial power of the United States shall be vested in one Supreme Court, and in such inferior courts as the Congress may from time to time ordain and establish. The judges, both of the Supreme and inferior courts, shall hold their offices during good behavior, and shall at stated times receive for their services a compensation which shall not be diminished during their continuance in office.

Section 2

1. The judicial power shall extend to all cases in law and equity arising under this Constitution, the laws of the United States, and treaties made, or which shall be made, under their authority; to all cases affecting ambassadors, other public ministers and consuls; to all cases of admiralty and maritime jurisdiction; to controversies to which the United States shall be a party; to controversies between two or more States, between a State and citizens of another State, between citizens of different States, between citizens of the same State claiming lands under grants of different States, and between a State, or the citizens thereof, and foreign states, citizens, or subjects.

CONSTITUTION OF THE UNITED STATES

2. In all cases affecting ambassadors, other public ministers, and consuls, and those in which a State shall be party, the Supreme Court shall have original jurisdiction. In all the other cases before mentioned the Supreme Court shall have appellate jurisdiction both as to law and fact, with such exceptions and under such regulations as the Congress shall make.

3. The trial of all crimes, except in cases of impeachment, shall be by jury, and such trial shall be held in the State where the said crimes shall have been committed; but when not committed within any State the trial shall be at such place or places as the Congress may by law have directed.

Section 3

1. Treason against the United States shall consist only in levying war against them, or in adhering to their enemies, giving them aid and comfort. No person shall be convicted of treason unless on the testimony of two witnesses to the same overt act, or on confession in open court.

2. The Congress shall have power to declare the punishment of treason, but no attainder of treason shall work corruption of blood or forfeiture except during the life of the person attained.

ARTICLE IV.

Section 1

Full faith and credit shall be given in each State to the public acts, records, and judicial proceedings of every other State. And the Congress may by general laws prescribe the manner in which such acts, records, and proceedings shall be proved, and the effect thereof.

Section 2

1. The citizens of each State shall be entitled to all privileges and immunities of citizens in the several States.

2. A person charged in any State with treason, felony, or other crime, who shall flee from justice, and be found in another State, shall, on demand of the Executive authority of the State from which he fled, be delivered up, to be removed to the State having jurisdiction of the crime.

3. No person held to service or labor in one State, under the laws thereof, escaping into another shall in consequence of any law or regulation therein, be discharged from such service or labor, but shall be delivered up on claim of the party to whom such service or labor may be due.

Section 3

1. New States may be admitted by the Congress into this Union; but no new State shall be formed or erected within the jurisdiction of any other State, nor any State be formed by the junction of two or more States, or parts of States, without the consent of the Legislatures of the States concerned, as well as of the Congress.

2. The Congress shall have power to dispose of and make all needful rules and regulations respecting the territory or other property belonging to the United States; and nothing in this Constitution shall be so construed as to prejudice any claims of the United States, or of any particular State.

Section 4

The United States shall guarantee to every State in this Union a Republican form of government, and shall protect each of them against invasion, and, on application of the Legislature, or of the Executive (when the Legislature cannot be convened), against domestic violence.

ARTICLE V.

The Congress, whenever two-thirds of both Houses shall deem it necessary, shall propose amendments to this Constitution, or, on the application of the Legislatures of two-thirds of the several States, shall call a convention for proposing amendments, which, in either case, shall be valid to all intents and purposes, as part of this Constitution, when ratified by the Legislatures of three-fourths of the several States, or by conventions in three-fourths thereof, as the one or the other mode of ratification may be proposed by the Congress; provided that no amendment which may be made prior to the year one thousand eight hundred and eight shall in any manner affect the first and fourth clauses in the Ninth Section of the First Article; and that no State, without its consent, shall be deprived of its equal suffrage in the Senate.

ARTICLE VI.

1. All debts contracted and engagements entered into before the adoption of this Constitution shall be as valid against the United States under this Constitution as under the Confederation.

2. This Constitution and the laws of the United States which shall be made in pursuance thereof and all treaties made, or which shall be made, under the authority of the United States, shall be the supreme law of the land, and the judges in every State shall be bound thereby, anything in the Constitution or laws of any State to the contrary notwithstanding.

3. The Senators and Representatives before mentioned, and the members of the several State Legislatures, and all executive and judicial officers, both of the United States and of the several States, shall be bound by oath or affirmation to support this Constitution; but no religious test shall ever be required as a qualification to any office or public trust under the United States.

ARTICLE VII.

The ratification of the Conventions of nine States shall be sufficient for the establishment of this Constitution between the States so ratifying the same.

AMENDMENTS TO THE CONSTITUTION
OF THE UNITED STATES

ARTICLE I.

Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech or of the press; or the right of the people peaceably to assemble and to petition the Government for a redress of grievances.

ARTICLE II.

A well-regulated militia being necessary to the security of a free State, the right of the people to keep and bear arms shall not be infringed.

ARTICLE III.

No soldier shall, in time of peace, be quartered in any house without the consent of the owner, nor in time of war but in a manner to be prescribed by law.

ARTICLE IV.

The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

ARTICLE V.

No person shall be held to answer for a capital or other infamous crime unless on a presentment or indictment of a Grand Jury, except in cases arising in the land or naval forces, or in the militia, when in actual service, in time of war or public danger; nor shall any person be subject for the same offense to be twice put in jeopardy of life or limb; nor shall be compelled in any criminal case to be a witness against himself, nor be deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use without just compensation.

ARTICLE VI.

In all criminal prosecutions, the accused shall enjoy the right to a speedy and public trial, by an impartial jury of the State and district wherein the crime shall have been committed, which districts shall have been previously ascertained by law, and to be informed of the nature and cause of the accusation; to be confronted with the witnesses against him; to have compulsory process for obtaining witnesses in his favor, and to have the assistance of counsel for his defense.

ARTICLE VII.

In suits at common law, where the value in controversy shall exceed twenty dollars, the right of trial by jury shall be preserved, and no fact tried by a jury shall be otherwise re-examined in any court of the United States than according to the rules of the common law.

ARTICLE VIII.

Excessive bail shall not be required, nor excessive fines imposed, nor cruel and unusual punishments inflicted.

ARTICLE IX.

The enumeration in the Constitution of certain rights shall not be construed to deny or disparage others retained by the people.

ARTICLE X.

The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people.

ARTICLE XI.

The judicial power of the United States shall not be construed to extend to any suit in law or equity, commenced or prosecuted against one of the United States, by citizens of another State, or by citizens or subjects of any foreign state.

ARTICLE XII.

The Electors shall meet in their respective States, and vote by ballot for President and Vice-President, one of whom at least shall not be an inhabitant of the same State with themselves; they shall name in their ballots the person voted for as President, and in distinct ballots the person voted for as Vice-President; and they shall make distinct list of all persons voted for as President, and of all persons voted for as Vice-President, and of the number of votes for each, which list they shall sign and certify, and transmit, sealed, to the seat of the Government of the United States, directed to the President of the Senate; the President of the Senate shall, in the presence of the Senate and House of Representatives, open all the certificates and the votes shall then be counted; the person having the greatest number of votes for President shall be the President, if such number be a majority of the whole number of Electors appointed; and if no person have such majority, then from the persons having the highest number, not exceeding three, on the list of those voted for as President, the House of Representatives shall choose immediately, by ballot, the President. But in choosing the President, the votes shall be taken by States, the representation from each State having one vote; a quorum for this purpose shall consist of a member or members from two-thirds of the States, and a majority of all the States shall be necessary to a choice. And if the House of Representatives shall not choose a President, whenever the right of choice shall devolve upon them, before the fourth day of March next following, then the Vice-President shall act as President, as in the case of the death or other constitutional disability of the President. The person having the greatest number of votes as Vice-President shall be the Vice-President if

such number be a majority of the whole number of Electors appointed, and if no person have a majority, then from the two highest numbers on the list the Senate shall choose the Vice-President; a quorum for the purpose shall consist of two-thirds of the whole number of Senators, and a majority of the whole number shall be necessary to a choice. But no person constitutionally ineligible to the office of President shall be eligible to that of Vice-President of the United States.

ARTICLE XIII.

1. Neither slavery nor involuntary servitude, except as a punishment for crime whereof the party shall have been duly convicted, shall exist within the United States, or any place subject to their jurisdiction.

2. Congress shall have power to enforce this article by appropriate legislation.

ARTICLE XIV.

1. All persons born or naturalized in the United States, and subject to the jurisdiction thereof, are citizens of the United States and of the State wherein they reside. No State shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States; nor shall any State deprive any person of life, liberty, or property without due process of law, nor deny to any person within its jurisdiction the equal protection of the laws.

2. Representatives shall be apportioned among the several States according to their respective numbers, counting the whole number of persons in each State excluding Indians not taxed. But when the right to vote at any election for the choice of Electors for President and Vice-President of the United States, Representatives in Congress, the executive and judicial officers of a State, or the members of the Legislature thereof, is denied to any of the male inhabitants of such State, being twenty-one years of age, and citizens of the United States, or in any way abridged, except for participation in rebellion, or other crime, the basis of representation therein shall be reduced in the proportion which the number of such male citizens shall bear to the whole number of male citizens twenty-one years of age in such State.

3. No person shall be a Senator or Representative in Congress, or Elector of President and Vice-President or holding any office, civil or military, under the United States, or under any State, who, having previously taken an oath, as a member of Congress, or as an officer of the United States, or as a member of any State Legislature or as an executive or judicial officer of any State, to support the Constitution of the United States, shall have engaged in insurrection or rebellion against the same, or given aid and comfort to the enemies thereof. But Congress may, by a vote of two-thirds of each House, remove such disability.

4. The validity of the public debt of the United States, authorized by law, including debts incurred for payment of pensions and bounties for services in suppressing insurrection and rebellion, shall not be

questioned. But neither the United States nor any State shall assume or pay any debt or obligation incurred in aid of insurrection or rebellion against the United States, or any claim for the loss or emancipation of any slave; but all such debts, obligations, and claims shall be held illegal and void.

5. The Congress shall have power to enforce by appropriate legislation the provisions of this article.

ARTICLE XV.

1. The right of the citizens of the United States to vote shall not be denied or abridged by the United States or by any State on account of race, color, or previous condition of servitude.

2. The Congress shall have power to enforce the provisions of this article by appropriate legislation.

ARTICLE XVI.

The Congress shall have power to lay and collect taxes on incomes, from whatever sources derived, without apportionment among the several States, and without regard to any census or enumeration.

ARTICLE XVII.

1. The Senate of the United States shall be composed of two Senators from each State, elected by the people thereof, for six years; and each Senator shall have one vote. The electors in each State shall have the qualifications requisite for electors of the most numerous branch of the State Legislatures.

2. When vacancies happen in the representation of any State in the Senate, the executive authority of such State shall issue writs of election to fill such vacancies: Provided, That the Legislature of any State may empower the Executive thereof to make temporary appointment until the people fill the vacancies by election as the Legislature may direct.

3. This amendment shall not be so construed as to affect the election or term of any Senator chosen before it becomes valid as part of the Constitution.

ARTICLE XVIII.

1. After one year from the ratification of this article the manufacture, sale, or transportation of intoxicating liquors within, the importation thereof into, or the exportation thereof from the United States and all territory subject to the jurisdiction thereof for beverage purposes is hereby prohibited.

2. The Congress and the several States shall have concurrent power to enforce this article by appropriate legislation.

3. This article shall be inoperative unless it shall have been ratified as an amendment to the Constitution by the Legislatures of the several States, as provided in the Constitution, within seven years from the date of the submission hereof to the States by the Congress.

ARTICLE XIX.

1. The right of citizens of the United States to vote shall not be denied or abridged by the United States or by any State on account of sex.

2. Congress shall have power, by appropriate legislation, to enforce the provisions of this article.

PROPOSED CHILD LABOR AMENDMENT

Section 1—The Congress shall have power to limit, regulate, and prohibit the labor of persons under eighteen years of age.

Section 2—The power of the several States is unimpaired by this article except that the operation of State laws shall be suspended to the extent necessary to give effect to legislation enacted by the Congress.

PROPOSED "LAME DUCK" AMENDMENT

Section 1. The terms of the President and Vice President shall end at noon on the 20th day of January and the terms of Senators and Representatives at noon on the 3d day of January, of the years in which such terms would have ended if this article had not been ratified; and the terms of their successors shall then begin.

Section 2. The Congress shall assemble at least once in every year, and such meeting shall begin at noon on the 3d day of January, unless they shall by law appoint a different day.

Section 3. If, at the time fixed for the beginning of the term of the President, the President-elect shall have died, the Vice President-elect shall become President. If a President shall not have been chosen before the time fixed for the beginning of his term, or if the President-elect shall have failed to qualify, then the Vice President-elect shall act as President until a President shall have qualified; and the Congress may by law provide for the case wherein neither a President-elect nor a Vice President-elect shall have qualified, declaring who shall then act as President, or the manner in which one who is to act shall be selected, and such persons shall act accordingly until a President or Vice President shall have qualified.

Section 4. The Congress may by law provide for the case of the death of any of the persons from whom the House of Representatives may choose a President whenever the right of choice shall have devolved upon them, and for the case of the death of any of the persons from whom the Senate may choose a Vice President whenever the right of choice shall have devolved upon them.

Section 5. Sections 1 and 2 shall take effect on the 15th day of October following the ratification of this article.

Section 6. This article shall be inoperative unless it shall have been ratified as an amendment to the Constitution by the Legislatures of three-fourths of the several States within seven years from the date of its submission.

BIBLIOGRAPHY.—C. A. Beard, *An Economic Interpretation of the Constitution of the United States*, 1913; C. W. Warren, *The Making of the Constitution*, 1928; W. W. Willoughby, *The Constitutional Law of the United States*, 1929; W. S. Myers, *The American Government of Today*, 1931.

CONSUL, a term used in a specific sense to denote a particular grade in the consular service, but also used in a generic sense to embrace all consular officers. The office grew out of the necessity to exercise some jurisdiction over seamen, vessels and merchandise. The modern consul is the business representative of his country. He is stationed at the salient ports and trade centers of a country and especially where protection is required for his country's interests. The consul is authorized to perform his duties by means of an *EXEQUATUR*, which defines the limits of his district. Under international law a consul does not enjoy the diplomatic character and therefore is not exempt from local law. Immunities are extended to consuls by custom and treaty agreement.

Consuls, in the Roman republic were the two highest officers elected annually in the *comitia centuriata* (see *COMITIA*) as the last office in the *cursus honorum*, combining civil and military authority. They tried cases usually only on appeal, convoked the senate and other assemblies, received ambassadors, carried out the decrees and laws of the various legislative bodies, raised and commanded the armies in the field. They could nullify each other's acts, and alternated in authority in the city of Rome each month and in the army every day. Their names dated the years.

CONSULAR JURISDICTION, the investment of consuls to Eastern countries with judicial functions in cases to which the nationals of the consul's country are parties to the controversy. This jurisdiction is based in part upon custom, but mainly upon treaties. Consular jurisdiction implies an exemption from the operation of local law, and an amenability to the laws of one's own country, as administered and applied by the consul.

CONSUMERS' CREDIT. See **INSTALLMENT BUYING**.

CONSUMERS' GOODS, in economic theory, a term applied to goods bought by ultimate consumers for consumption or use rather than as means to production. It includes such classes of articles as foods, clothing, and furniture, in the hands of consumers. In a technical economic sense, such products, while belonging to retailers, jobbers, or manufacturers, are not consumers' but producers' goods, since the process of their production is not yet complete. In the business or marketing sense, the term includes articles intended more or less immediately for use by consumers regardless of present ownership. They are habitually bought on the basis of the whims or personal taste of consumers, rather than by the application of objective tests of quality or suitability.

CONSUMPTION. See **TUBERCULOSIS**.

CONSUMPTION, in **ECONOMICS** the use of goods in the satisfaction of human want. Goods are commodities that can satisfy human wants. The specific qualities in the goods that satisfy wants are utilities. Consumption may mean the immediate destruction of goods, as in the case of foods, or it may mean the using up of goods over a period of time as in the case of wearing apparel and furniture.

Consumer demand is the human want for economic goods accompanied by the power and desire to buy. All business activity is directly dependent upon consumption. Under the present industrial system, production is directly dependent upon the sale of commodities to the ultimate consumer. A manufacturer is warranted in continuing to manufacture his goods only when he has orders or has a reasonable assurance that orders will be placed by his customers. Likewise, the retailer purchases from the wholesalers and manufacturers only when he in turn anticipates a demand from his customers. Articles may be manufactured temporarily for stock, but unless there is a demand the plant is forced to shut down. Production and consumption, therefore, are coordinated factors in industry. The exchange of goods and service between producers and consumers, with money as the medium of exchange, is the foundation of the entire modern business structure. Instead of waiting passively for the customer to purchase, the manufacturer and retailer actively solicit patronage. They make their goods attractive, they display them effectively and they advertise extensively, all with one end in view—to increase consumption. Consumption is the ultimate goal for all economic goods and the consumer pays the complete costs of production and distribution. J. L. F.

CONSUMPTION TAX, a tax on the private expenditures of taxpayers for articles of consumption, usually those commodities classed as luxuries. For administrative purposes consumption taxes are classed either as excises or customs duties. See also INTERNAL REVENUE.

CONTACTORS, ELECTRIC, devices for closing or opening electric circuits under normal conditions. See also CIRCUIT BREAKER. The contacts are usually of copper, sometimes supplemented with auxiliary carbon contacts. They are operated electromagnetically, pneumatically and mechanically.

CONTE (French *conte*, a story), an anecdote told in narrative style. It is unlike the TALE in that it must preserve anecdotal unity. Although the conte may be of any length, it has come to be applied only to short stories. Perrault's *Contes de ma Mère l'Oye* ("Mother Goose Tales," 1697) are among the earliest examples of this type, which reached high development in France. In the 18th century, VOLTAIRE introduced the *conte philosophique*, but his *Candide*, not possessing unity, does not properly come under this heading. Other famous stories are Balzac's *Contes Drolatiques*, 1855, and those of DE MAUPASSANT. American writers have produced few contes, although one or more may be found in the works of several famous short story writers, as *The Gift of the Magi*, by O. Henry, and several of Poe's tales of horror.

CONTEMPT OF COURT, an act or word indicating disobedience of the court or disrespect for its dignity. "A willful disregard of the authority of the court of legislature." (11 Mont. 126.) Contempt can be shown for the power of the court, as well as for its authority. Direct contempt is something done

or not done in the actual presence of the court. Constructive contempt is something done out of court which tends to belittle or obstruct the administration of justice. Civil contempt as distinguished from criminal contempt is, generally speaking, a disobedience of the order of a court rather than an overt insult. In determining whether language was or was not a contempt, regard must be had not merely to the words used, but to the surrounding circumstances: the connection in which they were used, the tone, the look, the manner and the emphasis. (*In re Cooper*, 32 Vt. 253.)

CONTINENT, one of the major land masses of the globe. Separated by oceans which constitute the corresponding great water areas, the continents might rank as islands, but for their great size. From the standpoint of the physiographer, there are six continents: Eurasia, comprising Europe and Asia; Africa; North America; South America; Australia, and Antarctica. It is, however, usual to regard Europe and Asia as separate "grand divisions" of land.

The true continents are vast blocks, or plateaus, only a portion of which projects above the sea. Each rises from a gently sloping, submerged shelf, known as the continental platform, which dips seaward to a depth of about 600 ft. Beyond this a sudden drop descends to abysmal depths, about 6,000 ft. Offshore islands and shoals, among them the British Isles, and the world's great fishing-banks, represent elevations of the continental shelf.

The continuance to the edge of the continental platform of features of land topography, as the Hudson Valley, appears to indicate that these shelves represent former land areas now worn down and submerged. If the continents should be measured with their underwater extensions, estimated at 10,000,000 sq. mi., they occupy an area half that of the ocean basins, although sea-water actually covers an area three times that of the dry land.

Continental elevations and deep-sea depressions constitute the grand relief features of the globe. From the highest point of land, the peak of Mt. Everest (29,140 ft.), to the lowest known depth (more than 6 mi.), near the Philippine Islands, the distance is over 11 mi. If the land with its varied relief of mountains, plateaus, plains, valleys, canyons, and shallow basins, and also the ocean floor, were reduced to a common level, the average elevation of the land would be found to be somewhat under a half mile, and the average depression of the ocean basin as 2½ miles below sea level. Most of the earth's population is gathered upon about three-fifths of the land at elevations of less than 1,640 ft. above the sea. M. B. H.

CONTINENTAL CONGRESS, the extra-legal association of delegates of the British colonies in America which, beginning as an advisory and consultative body, became the Government pro tem of the United States during the REVOLUTIONARY WAR. The burgesses of the legislature of Virginia on May 27, 1774 adopted a resolution recommending an annual congress of all the colonies "to deliberate on those

general measures which the united interests of America may from time to time require." All colonies except Georgia concurred, and the First Continental Congress, of 55 members from 12 colonies, assembled at Carpenters' Hall, Philadelphia, Sept. 5, 1774. Peyton Randolph of Virginia was chosen president, and Charles Thompson (not a member) of Philadelphia, secretary. This congress was in secret session for seven weeks, and promulgated a Declaration of Rights and Grievances listing 13 Acts of Parliament as "infringements and violations of the rights of the colonists;" a petition to the king of England; an address to the people of Quebec soliciting their cooperation; an address to the people of Great Britain; and a memorial to the people of the colonies; devised the Association, to end trade with Great Britain; and discussed the GALLOWAY PLAN. The Second Continental Congress assembled in the state house at Philadelphia, May 10, 1775. On June 14 when it resolved that a continental army should be raised the congress committed itself to sovereign functions which it continued to exercise until the ARTICLES OF CONFEDERATION provided a fundamental law. Throughout the Revolutionary War the Congress served, as well as a body without powers of raising money could serve, as a National Government. The presidents of the Second Continental Congress were, successively, Peyton Randolph, John Hancock, Henry Laurens, John Jay and Samuel Huntington.

CONTINENTAL DIVIDE, the height of land in the United States separating the waters flowing to the Pacific from those draining into the Atlantic. Beginning at the Mexican boundary, it follows an indistinct course northward across western New Mexico but in Colorado becomes a part of the Rocky Mountains. Here it follows the crest of the San Juan range, changes to the Sawatch range, loops east to the Front range and then back to the Park range which it follows into Wyoming. In this state it crosses the Great Divide basin to reach the Wind River Mountains, crosses Yellowstone Park, and then follows the Idaho-Montana boundary to the latitude of Butte. It swerves east as far as that city and continues almost due north through Glacier Park to the Canadian boundary. The rivers separated by this water parting are the Columbia, Snake and Colorado on the west and the Missouri, Platte, Arkansas and Rio Grande on the east.

CONTINENTAL SYSTEM, the name given to the plan of Napoleon to strike at Great Britain by completely cutting her off from commerce with the continent. His BERLIN DECREE, Nov. 21, 1806, declared a blockade against the British Isles, prohibited all trade with them, and closed French and allied ports to ships from Great Britain or her colonies. The British replied by Orders in Council, declaring those ports in a state of blockade from which British ships and goods were excluded and forbidding neutral ships to visit such ports unless they had first taken on British goods at British ports.

Napoleon then issued the Milan Decree of Dec.

17, 1807, declaring any ship subject to capture that submitted to search by British cruisers, made a compulsory voyage to a British port, or sailed either from British ports or from countries occupied by British troops. Thus he struck at the export of British goods in neutral vessels. In the drastic Fontainebleau Decrees, Oct. 18 and 25, he went a step further and ordered all British manufactures found in the Napoleonic states to be seized and burned and provided for the seizure and trial of those who imported illicit goods. Meanwhile the effects of British Orders in Council and Napoleonic Decrees were greatly mitigated by licenses issued by both combatants, which allowed relaxations of the codes, especially to neutral countries.

There is no question that the industrial population of England suffered severely under the system. Raw materials rose tremendously in price, and in 1812 the British people were facing famine through the scarcity of bread stuffs. One result of the friction that arose from the difficulties of neutrals was the WAR OF 1812 between the United States and Great Britain.

On the other hand, Napoleon found it more and more difficult to make commerce "manœuvre like a regiment," as his minister Chaptal said, and his attempts to do so became suicidal. At first all the countries in Europe except Portugal fell in with the plan; but as their industry and commerce continued to suffer, until they were threatened with economic ruin, smuggling on a gigantic scale rapidly developed. Recognizing the opportunities of defeating Napoleon's system by this method, the English organized a system of their own to get goods into the continent despite the vigilance of the French and their reluctant allies. Heligoland and Malta were used as strategic bases from which as from neutral countries English and colonial goods were smuggled into Europe. A regular system of illicit trade developed. But being illegal, it gave rise constantly to friction with the authorities, especially in places where French control was effective. Discontent grew apace until it assumed the proportion of national revolts. In his determination to enforce the system, notwithstanding the opposition of reluctant peoples, Napoleon coerced one state after another. The great breach finally came when Russia, which needed English manufactures, sugar, coffee and other colonial goods in exchange for her raw products, refused to continue the agreement made at Tilsit in 1807. Indignant at the defection of his ally, Napoleon determined to force Tsar Alexander I to carry on, and declared war. The disastrous campaign in Russia and the destruction of the Grand Army marks the first great breach in the Continental System which was finally swept aside in its entirety as Central Europe rose against Napoleon in the War of Liberation. A. L. L.

See E. F. Hecksher, *Continental System*, 1923.

CONTINUATION SCHOOLS, schools maintained usually by the public school system for students from 14 to 17 who wish to go to work but are still obliged by law to attend school for four to eight hours

a week. Compulsory school attendance laws are operative in nearly two-thirds of the states, and employers are obliged by law to arrange for this regular attendance. These schools stress vocational guidance and training and assist students in getting positions.

CONTINUED FRACTION, a fraction in such a form as:

$$3 + \frac{4}{6 + \frac{4}{6 + \dots}}$$

There are also forms in which the numerator is continued in like manner. Two of the most interesting continued fractions are the following, the first involving the value of π , due to Lord Brouncker; and the second that of e , due to Euler, the base of natural, or hyperbolic, logarithms:

$$\frac{4}{\pi} = 1 + \frac{1}{2 + \frac{9}{2 + \frac{25}{2 + \frac{49}{2 + \dots}}}}$$

$$e = 2 + \frac{1}{1 + \frac{1}{2 + \frac{1}{1 + \frac{1}{4 + \dots}}}}$$

Such fractions were first studied (1613) in their modern form by Cataldi (1548-1626). The modern theory begins with Euler (1737). See FRACTIONS.

CONTINUITY, or continuum, a succession of points or numbers having the property that however small the interval between two successive points may be there is in that interval a finite number of points through which it is possible to proceed from one end of the interval to the other. Such a system may be represented by an infinite straight line generated by a moving point.

CONTINUOUS WAVES, waves which, when unmodulated, are of constant amplitude. Such waves are necessary as the carrier in radio broadcasting, since irregularities in the carrier itself would be heard with the reproduced program. See also HERTZIAN WAVES; RADIO COMMUNICATION.

CONTINUUM, that which possesses continuity. In psychology the term is used to designate an undifferentiated sensory matrix out of which meaning is born. James's "big, blooming, buzzing confusion" is such a psychological continuum. A mathematical continuum is generated by including all the points represented by the entire number series, i.e., taking into consideration the whole numbers and fractions, together with the irrational fractions. Between any two points an infinite number of points may be located. This gives rise to the idea of the continuum.

CONTOUR LINES, a term used in geography to denote lines drawn on a map which pass through points of equal elevation above, or depression below,

sea level. Dependent upon the scale of the map used, they may be drawn at intervals of altitude ranging from a few feet to more than 1,000 feet. Their general appearance, curvature, etc. then tell at a glance the character of the undulations of the country. See also MAPS AND MAPPING.

CONTRABAND, a term applied to commodities susceptible of use by a belligerent in carrying on war and having an enemy destination. Difficulties attendant upon the application of the law of contraband grow out of differing views as to what articles are susceptible of use in prosecuting war as well as out of differing opinions as to what constitutes hostile destination or proof of hostile destination. Conflicting interests lead to inconsistent claims. Arms, ammunition, ordnance, military clothing, military camp equipment, armor plate, implements designed exclusively for the manufacture of munitions of war and similar commodities primarily adapted and used for belligerent purposes, are referred to as absolute contraband. Articles that may be used in peace as well as in war are referred to as conditional contraband, and upon a showing that they are destined for use by the enemy forces become liable to be dealt with in like manner as absolute contraband. The law of war permits a belligerent to seize as prize contraband of war en route on the high seas or in the territorial waters of either belligerent to the opposing belligerent.

In time of peace contraband generally comes under the head of smuggling.

BIBLIOGRAPHY—C. C. Hyde, *International Law, International Law Situations*; U.S. Naval War College, 1927; H. R. Pyke, *The Law of Contraband of War*.

CONTRACT, LAW OF. Contract, in law, is an agreement containing one or more promises which can be enforced in court. Enforcement, as to contracts for the sale of land, consists in making the defendant do what he promised—or doing it for him; but for most contracts enforcement consists merely in a judgment for damages. (See ADMINISTRATION OF LAW.) The rules about damages attempt to put the promises in as good a position as if the contract had been performed, but they rarely do; lawyer's fees alone would be enough to prevent that. But the contract-breaker is commonly quite as badly off after the law-suit as if he had performed, unless he is protected by BANKRUPTCY. The legal pressure to perform is thus tangle, in most cases.

Lawyers distinguish unilateral contracts from bilateral. The former carry a promise only on one side (insurance policy, with no promise to pay the premium; reward offered, with no promise by the offeree to earn it; cash loan with promise to repay in the future.) Much more common are bilateral contracts, carrying mutual promises (contract to buy and sell). In both cases a promisor must get what he bargained for before he has to perform; but he can commonly withdraw from the unilateral contract at any time until he gets all he bargained for, whereas he cannot withdraw from the bilateral once the two

promises have been exchanged and a true agreement expressed. ("Offer and acceptance" of the same bargain.) Not only must a promisor get what he bargains for, but in our law he must bargain for something ("consideration"), if his promise is to move a court into action. A mere promise, unpaid for, (e.g., to give money; to give an option) does not interest the court; it is only as good as the promisor's word. In many states an old form does remain, of writing a promise and putting a "seal" on it, which removes the necessity for a bargain-equivalent; but the law of sealed contracts is so tricky and technical as to make them dangerous to work with.

It is not enough, however, to have an agreement and a consideration. The agreement must be clear enough so that a court can tell what it means. And, more important, there are a number of common types of promise which are unenforceable unless in writing and signed (Statute of Frauds). This is true, especially, of contracts concerning sale of an interest in land (commonly excluding short leases), contracts by which one man agrees to answer for another (guaranty); and contracts for the sale of goods above a fixed value (commonly fifty dollars), unless part payment has been made, or part delivered and accepted. A formal writing with "whereas" is unnecessary; it pays to remember that letters can be as binding as lawyer-drawn documents. The difficulty with letters is rather that they are likely to be loose in their language, and so give trouble when disputes arise. Even in regard to contracts not falling under the Statute of Frauds and therefore enforceable though made only by word of mouth, there is value in putting the agreement in writing. Thus we have the practice of "confirming" oral deals by exchange of letters. This makes clear whether the parties have really come to agreement, and makes clear what was agreed, memory is otherwise likely to change when troubles occur. A writing also gives a clear point of reference for purposes of calculation and performance. But it carries dangers. If the agreement is once reduced to writing, the writing is commonly regarded by a court as controlling (parol evidence rule). What is written, if it is complete in itself (e.g., the closing letters of a correspondence), commonly *displaces* in legal effect any other or different agreement made before or at the same time. Here lies danger to the unwary who sign the dotted line on a printed form. For the courts commonly hold that a man is as fully bound by what he had opportunity to read as by what he did read; and a persuasive agent's statement that the printed clauses are "only a form" is seldom of help before the judge. Some hope for the over-reached party in these cases resides in the rules giving relief by calling the contract off when misrepresentation or fraud has been practiced upon the complaining party when the agreement was made. But a layman needs to bear in mind that misrepresentation and fraud in this connection are legal terms, and narrow—not lay terms, and wide—and that they fail to include most of the things which he is likely to think they will.

A further requirement for enforcement of a contract is that the transaction be legally permissible. Contracts hiring a man to corrupt an official, gambling contracts, and the like, are obviously bad. So, too, are many specific clauses in otherwise enforceable agreements: an agreement by a shipper to release a railroad from the consequences of its own negligence, or by a mortgager to forfeit his rights if he does not pay on the day set. But our law has been slow in recognizing the need for doing something to balance bargains between the very powerful and the very weak. It still stands with one foot on the theory that all men are, for purposes of contracting, created equal. Hence many attempts by legislation to accomplish for workmen what they could not accomplish individually for themselves, have been declared unconstitutional as depriving men of their liberty; e.g., laws forbidding payment by credit at a company store; or limiting hours of work in occupations the court did not think dangerous; or prescribing minimum wages; or forbidding the "yellow-dog" clause by which a workman promises not to join an outside union. Here the field of contract touches on that of regulation of occupations at large, regulation, e.g., of the size of loaves of bread, or of ticket agencies, has met the same objection.

How far the law of contract, i.e., the court's enforcement of promises, is necessary to our business structure, is a difficult problem to decide. Certainly most business is done, most affairs are arranged—in this as in all other matters—not by recourse to the courts, but by the habits and practices of men. They make agreements, they trust each other, they perform their agreements, they adjust their differences about them. Yet it seems fairly clear that if no court were at hand when needed to make a delinquent pay up, fewer people—increasingly fewer people—would in fact perform what they had promised. Especially does this hold when relatives lose the personal and the coherent community pressure which were characteristic of village life. With dealings at a distance by mail and wire, with railroads to take a man and his assets into a new start elsewhere, with corporations displacing individuals in business, and especially with promises split up into single bonds and running over twenty years, the reliance placed upon the law must needs grow. The law of contract does not, therefore, displace the practice of performing agreements, or one man's faith in another. But it does potentially reinforce them when faith is misplaced or practice departed from. On the other hand, no legal remedy was ever as good as performance and the law of contract as it stands is hardly a match for a tricky promisor. The main reliance for performance of agreements thus remains the honesty and solvency of the promisor.

K. N. L.

CONTRACT LABOR, any alien or group of aliens making contract with an American industrial organization, which pays for their transportation to the United States in order to obtain their services at a price generally below that paid American la-

borers for comparable services. This type of labor has been consistently opposed by American labor unions. At their instance two acts were passed, one in 1885 and another in 1903, making it illegal under the immigration law for anyone "to prepay the transportation or otherwise assist or encourage the importation or migration of any foreigner into the United States, under contract to perform labor or service of any kind."

CONTRADICTION, PRINCIPLE OF, a logical rule which states that contradictory predicates cannot both be attributed to the same subject at the same time and in the same sense; if one attribution is true the other must be false. This is best illustrated by what is known as the square of opposition. Here the A (universal affirmative) and the O (particular negative) propositions are contradictories; likewise with the E (universal negative) and the I (particular affirmative) propositions. If "all men are liars" is a false proposition, then it follows that its contradictory, "some men are not liars," is true. If it is true that no government is perfect, it is not true that some governments are perfect. If a proposition is true, its contradictory must be false; both cannot be true at the same time.

CONTRALTO, the lowest female voice, having a normal compass from f to d'; see **ALTO**.

CONTRERAS, BATTLE OF, Aug. 19-20, 1847, one of the chief battles of the MEXICAN WAR. Having fought their way through CERRO GORDO, the Americans under Gen. Scott resumed the drive toward Mexico City. Easily taking the city of Puebla, where he left 2,300 wounded in hospitals, Scott advanced to the outskirts of the capital city. The hill of Contreras, 12 miles southwest of the city, was carried by an unexpected assault of 4,500 American troops, led by Scott himself, against a Mexican force of 7,000 under Gen. Valencia. An early morning attack on the 20th on both front and rear broke the Mexican line. The Mexican loss was 700 killed and fully that number captured; the American casualties were 60.

CONTRIBUTIONS. See **REQUISITION**.

CONTROLLERS, ELECTRIC. See **ELECTRIC CONTROLLERS**.

CONUNDRUM, a riddle in the form of a question, based on the similarity and dissimilarity of two things, the answer to which involves a pun. Formerly, it was a word applied to any absurd idea or proposition. The following conundrum is found in the literature of many ancient peoples: "What is wingless and legless, yet flies fast and cannot be imprisoned?" Answer: "The voice." The next is a modern example: "Why is an orange like a church steeple?" Answer: "Because we have a peel from it."

CONVECTION, the conveyance of heat by actual motion of matter. When the temperature of a body of fluid is raised, its density is diminished. Hence, if only a part of the body be heated, a difference in density will be produced within it. This difference in density will set up currents in the fluid by which

the heated, or less dense, parts will be transferred to the cooler, or more dense, regions, the cooler portions being brought to the source of heat. This motion is due to the force of gravity and takes place only when the source of heat and, consequently, the regions of less density, are at the lower levels. Obviously, convection can occur only in liquids and gases, not in solids. Due to their low thermal conductivity, fluids transfer heat almost entirely by convection. Among the more familiar applications are central heating plants for buildings and ventilation without the use of fans or blowers and condensing systems. Ocean currents and the winds are examples of convection in nature. See also **HEATING OF BUILDINGS; VENTILATION**.

CONVENT, from the Latin *conventus*, an assembly of citizens in the Roman provinces, gathered together for the administration of justice. It came to be used in early Christian history to describe a religious establishment. In the history of monasticism the word has two distinct though related meanings: a monastic society of either sex in its corporate capacity, and the house or home of the religious order. In popular usage a convent has come to signify the house of religious women or nuns, just as the term monastery has come to denote only houses inhabited by monks. Convents were formerly distinguished as inclosed and uninclosed, but of recent years they are more apt to be classified according to the work done by the nuns, whose activities range over the fields of education, nursing and hospital service, district visiting, rescue work and contemplation. The lives of prayer and mortification characteristic of the ancient convents have been enlarged also to cover all forms of practical social service.

CONVENTION, CONSTITUTIONAL. See **CONSTITUTIONAL CONVENTION**.

CONVENTION, POLITICAL, an agency developed by American parties more than a century ago for the purpose of formulating platforms (see **PARTY PLATFORMS**) and nominating candidates. Each electoral area (aldermanic, senatorial, congressional and others) had its convention, the delegates being chosen at the party primaries or by conventions in the smaller areas below. The mass of party members formed the base of this pyramidal structure; the national convention formed the apex. Theoretically the system was democratic, but in practice it was corrupted at its popular source by manipulation of the primary and in the proceedings of the conventions themselves by political chicanery. After some experiments with statutory regulation, it was supplanted in the early years of this century by the direct primary. This change was made by statute, only a few states adhering to the old system. The national convention, which nominates party candidates for Presidency and Vice-Presidency, stands intact.

CONVENTION, THE. See **FRENCH REVOLUTION**.

CONVENTION OF 1818, a treaty between the United States and Great Britain, signed October 20, 1818. Richard Rush, U.S. Minister to England, and

ALBERT GALLATIN, then Minister to France, represented the American Government in the negotiations. The boundary of the United States west of the Lake of the Woods was defined as following the 49th parallel, N. lat., to the Rocky Mountains. The claims of American citizens for slaves carried off by the British during the Revolutionary War were recognized. And American citizens were granted the right to fish in Newfoundland and Labrador waters, with a few limitations. Although the original intention of the negotiators was to adjust all differences between the two countries, the dispute over the Maine-Canadian boundary was ignored, and the settlement of the rival claims to Oregon was postponed by an agreement that for 10 years the region should be free and open to the citizens of both countries.

CONVERGENCE, a term in anthropology. In the study of prehistoric times it is sometimes found that a complicated invention exists in the same form in widely separated parts of the world. Facts seem to preclude the possibility of one of the peoples using it having learned it from the other. In such cases many anthropologists consider that the invention was made independently in both countries, possibly with a great deal of difference in detail and that the two processes developed so as to have a remarkable resemblance to one another or, in other words, converged. In this way, baskets of almost identical type and design were made in Africa and in New Mexico; a form of calendar was worked out both in Babylon and Yucatan and fine weaving bearing points of similarity was done in India and Peru.

CONVERSE, FREDERICK SHEPHERD (1871-), American composer, was born at Newton, Mass., Jan. 5, 1871. He was graduated from Harvard University in 1893, and entered the Akademie der Tonkunst, Munich. In 1899 he joined the faculty of the New England Conservatory of Music at Boston, Mass., as instructor in harmony, and in 1903-07 served in like capacity at Harvard. His compositions include *The Mystic Trumpeteer*, a fantasy for orchestra, the operas *The Pipe of Desire*, produced at the Metropolitan Opera, New York, in 1910, and *The Sacrifice*, two symphonies, songs, and piano works.

CONVERSION, in law, exchanging of PROPERTY from real to personal or from personal to real. "No rule is better settled than that money directed to be employed in the purchase of land and land directed to be sold and converted into money are to be considered as that species of property into which they are directed to be converted, and this in whatever manner the direction is given, whether by WILL, CONTRACT, MARRIAGE, settlement or otherwise." (Collins *vs.* Champ B. M. Ky. 118.) Equitable conversion arises where, owing to the binding directions of a will, it becomes proper and legal for a court to treat REAL PROPERTY or estate as having been converted into PERSONAL PROPERTY, although there has been no actual exchange." (*In re McKay*, 75 N.Y. App. Div. 78.)

CONVERSION, a doctrine chiefly emphasized today by the Christian evangelical churches. As derived from the New Testament, it is a response to divine activity by virtue of which a change in disposition, desire and conduct takes place. For many years it became involved with the doctrine of predestination, and theologians disputed regarding the work of God or the Holy Ghost in the soul. To-day the emphasis is placed on the preaching which stirs the soul to seek a new life, and on the work of grace in confirming the convert in his new experience. Modern psychology has found the phenomena of conversion to be of three kinds: adolescent, which is part of the physical and mental changes of the adolescent period, accompanied by introspection, doubts, depression and longing for the ideal; adult, an ethical surrender of the will to the ideal, sometimes accompanied by strong and violent emotional disturbances; and progressive or gradual conversion, chiefly experienced by persons whose rational powers predominate.

CONVERSION, LOGICAL, the interchanging of the subject and predicate terms of a proposition without destroying its original meaning. The classical illustration is "all men are mortal." The converse of this proposition is "some mortal beings are men." Conversion here takes place by limitation, i.e., the predicate term cannot be brought over to the subject term without qualifying its quantity, thereby limiting the new subject to a particular rather than a universal assertion. Most A (universal affirmative) propositions are converted by limitation. It is only when the terms are coextensive that simple conversion may be used. E (universal negative) and I (particular affirmative) propositions are converted simply. If it is true that no human beings are infallible, it is also true that no infallible beings are human. The O (particular negative) proposition does not admit of either simple or limited conversion.

CONVERTER, a vessel used in treating metal to change its chemical composition. The term is generally applied to the Bessemer converter, which consists of a heavy sheet steel pear-shaped vessel suitably lined with an acid or basic refractory material. During the process a strong blast of air is forced through it from tuyères in the bottom. The vessel is mounted on trunnions and is tilted for charging and pouring. The bottom is detachable. A similar device is used in converting copper matte into crude copper. In CEMENTATION the converter is a furnace with an airtight fire-brick chamber for holding the charge. See also BESSEMER STEEL.

CONVERTER, ELECTRIC, a device for changing electrical energy of one form into another. The rotary, or synchronous, converter is a form of a motor-generator and consists of a combination of a synchronous motor (see MOTOR, ELECTRIC) and a direct-current generator (see ELECTRIC GENERATOR). Both motor and generator use the same windings on the ARMATURE. ALTERNATING CURRENT is applied to the SLIP RINGS on one end of the windings and, at the same time, the desired direct current is taken from the

COMMUTATOR on the other end. If a direct current is transformed into an alternating current by such a machine, the machine is known as an inverted rotary, or synchronous, converter.

Rotary converters are used to change the phase angle or the frequency of an alternating current. They are then known respectively as phase converters and frequency converters.

The **MERCURY-ARC RECTIFIER** is now also known as the mercury-arc converter, while the **TRANSFORMER**, although it has the function of a converter, is no longer referred to by that name.

CONVERTIBLE BONDS, bonds which may be converted into other securities of the issuing corporation at the option of the holder or at a certain price. Such bonds usually are convertible, at a specified price, into the corporation's authorized Stock. The market value of these securities fluctuates according to the movements of the stock into which they are convertible. This puts them in the speculative class. They are converted when the value of the stock into which they are convertible exceeds the value of the bonds. The object of a corporation in issuing convertibles is to create a large market for the issue. When such corporation is not able to raise additional capital from stock, and bonds could be sold at only a high interest rate, convertibles are floated. Convertible bonds are often secured by corporation property, equities and other assets and they rank above common and **PREFERRED STOCK** in liquidation proceedings the same as other bonds. Conservative investors regard their price fluctuations as too unstable to make convertibles desirable as permanent investment securities. See also **BONDS**.

CONVEYANCING, the transfer of titles to real estate from one owner to another. By act of the U.S. Congress, vessels can be recorded as transferred by conveyance. Also in some states the instrument used (called a conveyance) can include *Leases and Mortgages*. Unless there is a definite agreement, the expense of preparing the conveyance is borne by the purchaser and the execution of it by the vendor. Conveyancing is a special branch of the law, and in England and some other countries is done by men specializing in this branch of the law. See also **FRAUD**.

CONVEYING MACHINERY. See **MATERIALS HANDLING**.

CONVEYORS IN MASS PRODUCTION form an important function, not only in eliminating much manual labor, but also in timing the arrival of raw material of the various units to the **ASSEMBLY** line and in moving the finished product to storage or to the shipping platform. Conveyors time the movements of the workers, keep material off the floor and within easy reach, and eliminate much supervision. A product is frequently assembled, tested and boxed while in motion on a conveyor. See also **MATERIAL HANDLING**.

CONVICT, to find an accused guilty of whatever he is charged with. Sometimes used to indicate the verdict of the Jury. "Convicted is when a person has

been indicted by the grand jury, tried by a Court and jury, and found guilty of the offense charged in the **INDICTMENT**." (*Eagan vs. Jones*, 21 Nev. 433.) However, generally speaking, when the law "speaks of conviction it means a **JUDGMENT**, not merely a verdict."

CONVOLVULUS, a genus of plants of the family *Convolvulaceae*, including about 160 species of wide distribution, most abundant in the Mediterranean region. The plants are usually twining or trailing, with showy flowers resembling those of the morning-glory, to which they are closely related but from which they differ in their elongate stigmas. A few with large bracts concealing the calyx have sometimes been segregated as the genus *Calystegia*. Several species are in cultivation, such as the perennial California Rose (*Convolvulus japonicus*), and the annual *Convolvulus tricolor*. About 25 species are native or naturalized in the United States, of which the bindweeds (*Convolvulus sepium* and *C. arvensis*) become weeds.

CONVULSIONS. Violent muscular contractions of involuntary nature. In clonic convulsions the muscles contract and relax alternately. In tonic convulsions the contraction is continuous.

There are a variety of causes for convulsions in infancy and early childhood. Generalized convulsions are extremely common in early childhood and are probably explained by the relative instability of the young nervous system. Convulsions occurring immediately or soon after birth may be due to brain injury during delivery. In some babies, during the first few months of life, fits occur for which no cause can be found, and in some instances epilepsy makes its beginning in the form of infantile convulsions. In **RICKETS** there is a tendency to muscular spasm, and convulsions. This irritability of the central nervous system associated with rickets has been termed *spasmophilia*.

Such diseases of the brain as tumor, meningitis or encephalitis produce convulsions in both children and adults. In children, convulsions may occur at the onset of certain fevers, or during the course of others. Kidney disease in which there is uremia may also cause convulsions.

EPILEPSY of the major type is common at all ages and is characterized by generalized convulsions and loss of consciousness. In epilepsy there are both tonic and clonic muscular spasms.

A disturbance of the motor center in the brain as a result of injury, tumor formation or inflammation may produce the disorder known as **Jacksonian epilepsy**. It is distinguished from the ordinary form of epilepsy by the fact that consciousness is retained during an attack, or is lost later on in the course of the disease. The spasms may be limited to a few groups of muscles for years, but there is a great risk that the partial epilepsy may become general.

In the treatment of convulsions in children, a hot bath should be given and an enema administered. After the attack an ice-cap may be put on the head. When the convulsions are associated with rickets, the

treatment should be directed toward overcoming this disease. In all instances, a careful search for the cause of the convulsions should be made and if possible removed.

The convulsions of epilepsy should be treated according to the procedure in the disease. *See also* THROMBOSIS AND EMBOLISM. W. I. F.

CONWAY, a city of central Arkansas, the county seat of Faulkner Co., situated 31 mi. northwest of Little Rock. The Missouri Pacific railroad and bus lines afford transportation. It is the seat of the State Teachers College, Hendrix College and Central College. In a fertile agricultural region, Conway trades in cotton, corn, and dairy and farm produce. It manufactures cotton dresses and cotton seed oil and its products. Pop. 1920, 4,564; 1930, 5,534.

CONWAY CABAL, an intrigue designed to remove GEORGE WASHINGTON from the command of the Revolutionary Army in favor of Gen. Gates (*see* GATES, HORATIO). Gen. Thomas Conway was the leader of the faction, which included several prominent members of the army and the CONTINENTAL CONGRESS. When the plot was approaching success some of Gates's secret correspondence was apprehended by Washington and published, 1778. Public indignation was such that the plot collapsed, and Conway was virtually forced to leave the service.

COOK, JAMES (1728-79), English explorer and navigator, was born at Marton, Yorkshire, Oct. 27, 1728. He went to sea, joining the navy in 1755, rising in four years to be master of a ship. He was sent to the St. Lawrence River where he made charts, also of the coasts of Newfoundland and Labrador. His charts were favorably received by the Royal Society, which in 1768 gave him command of a ship carrying astronomers to the South Pacific Ocean to witness the transit of Venus. On this expedition Cook made surveys of the coasts of Australia and New Zealand, returning to England by way of the Cape of Good Hope, and was made a naval commander. He soon afterwards organized an expedition to the Antarctic. His two ships, *Resolution* and *Adventure*, were barred by the ice barrier at lat. 71°. In 1776 he headed a third expedition, which attempted to discover an Arctic passage connecting the Atlantic and Pacific oceans. Cook made a survey of the west coast of North America, including the Bering Straits and Alaskan Coast, finally returning to the Hawaiian Islands. He was killed by natives in one of the bays of Hawaii, Feb. 14, 1779.

COOKE, JAY (1821-1905), American banker and Civil War financier, was born at Sandusky, Ohio, Aug. 10, 1821. Beginning work as a clerk, in 1839 he obtained employment in the bank of E. W. Clark & Co., Philadelphia, Pa. In 1861 he formed the banking house of Jay Cooke & Co. He became unofficial adviser to Salmon P. Chase, Secretary of the Treasury under Lincoln. Appointed fiscal agent for the Government, he undertook to sell \$50,000,000 in treasury war-time bonds. Before the end of hostilities, he had sold \$500,000,000 in government securities. He at-

tempted to finance the Northern Pacific Railroad, an enterprise which, in 1873, forced his bank to close its doors, and was probably one of the causes of the panic of that year. Despite this disaster Cooke ultimately paid all claims, and regained his wealth. He died at Ogontz, Pa., Feb. 16, 1905.

COOKE, SIR WILLIAM FOTHERGILL (1806-79), English inventor, was born at Ealing in 1806. In 1837 he and his partner, Wheatstone, designed and built the first practicable telegraph apparatus in England, and in 1838 they laid the first line from London to West Drayton. He died Sept. 25, 1879.

COOKERY, the science and art of preparing food for daily consumption through the medium of heat. The preparation of raw materials in ways which maintain or increase their digestibility requires a knowledge of the scientific principles of cookery. The art of cookery involves the combination of flavors, textures, and colors to tempt the appetite and please the palate. The processes of cookery include boiling, stewing, steaming, broiling, roasting, baking, frying and sautéing.

Baking is cooking in the oven, and is a process used for making bread, cake, puddings, or for meats, fowl or fish.

Boiling is cooking in water at the boiling temperature, 212° F. Some foods, such as vegetables, especially green vegetables, should be cooked quickly in vigorously boiling water. Meats should be plunged into boiling water and boiled ten minutes to coagulate the protein on the surface and retain juice and flavor, then simmered (cooked just below the point at which water begins to bubble, or at a temperature of from 180° to 210° F.).

Broiling is cooking on a broiler grate or rack with the food exposed to the direct heat of the flame. In pan broiling, a frying pan is heated very hot and only enough fat used to prevent the food from sticking to the pan.

Frying is cooking in hot fat. The term "deep fat frying" is sometimes used when the food is immersed in fat, to distinguish this method of cooking from that in which less fat is used, but, strictly speaking, frying is always done in enough fat to cover the food. If a small amount of fat is used, the food is said to be sautéed.

Paper Bag Cookery. At one time meat and fish were often baked in oiled paper bags, with the idea that this efficiently retained juices and flavor, but this method of cooking is very seldom used today.

Roasting, as it was originally done, was the same as broiling, that is, cooking before an open fire. Today, roasting is done in the oven and therefore is the same as baking.

Sautéing refers to cooking done in a small amount of fat in which the food is tossed or turned while cooking.

Steaming is cooking in steam. A specially constructed utensil is necessary, in which water in the lower part boils and the steam, rising, cooks the food held in the upper section of the vessel.

Stewing is cooking in a small amount of water at or near the boiling point.

Casserole Dishes, dishes in which foods are cooked, usually in the oven, and brought to the table for serving. They are made of iron, aluminum, earthenware, glass and china, in various sizes and shapes, from the ramekin which holds a single portion to that suitable for a large family. In them foods may be baked, stewed or scalloped. They are most often used for preparing meats, vegetables, or combinations of these.

Fireless Cooker, a device for retaining heat in food which has been previously heated on the stove. It consists of utensils to hold the food and a container lined with insulating material and sometimes is provided with soapstones which may be heated and put above and below the food to aid in preventing rapid loss of heat. By this means foods cook slowly at a temperature below boiling and the amount of fuel used is small.

Pressure Cooker, a utensil in which cooking is done in steam under a pressure of, usually, from 10 to 15 lbs. By this means the time necessary to cook foods is decreased. It is therefore most useful in cooking those foods which require long cooking. It is also used for canning.

H. T. B.

COOLERS, apparatus for removing heat from fluids. For cooling the "brine" used in cooling and refrigerating systems, three types are in general use: the submerged-coil, the double-pipe and the shell-and-tube. The double-pipe type consists of an inner pipe, about two inches in diameter, through which the brine flows and an outer pipe, about three inches in diameter, through which the cooling substance, usually ammonia, passes. The submerged-tube type comprises tubes immersed in brine to conduct the cooling substance through it. The shell-and-tube type consists of tubes, connected between closed heads, and an enclosing shell. The brine flows through the tubes and the cooling substance surrounds them. These three types of coolers may be used for cooling other substances than brine, although that is their widest application.

Simple radiating coolers are often used where the temperature to which the substance is to be cooled is above that of atmospheric air. These comprise tubes, either of the plain or extended-surface type, which have a comparatively large area exposed to the air. The substance to be cooled flows through the tubes, usually by the force of gravity, and loses heat to the metal which, in turn, loses it to the air. This type of cooler is used in cooling the oil of large TRANSFORMERS.

In air conditioning, the air is often cooled by passing it through sprays of cool water.

COOLEY, THOMAS MCINTYRE (1824-98), American jurist and writer on constitutional law, was born at Attica, N.Y., Jan. 6, 1824. In 1846 he was admitted to the Michigan bar there. He was a reporter of the Michigan Supreme Court during 1858-65, during which period he compiled the general statutes of the State. Among the best known of his

works are *The Constitutional Limitations which rest upon the Legislative Power of the States and the American Union*, 1868, and *Story's Commentaries on the Constitution of the United States*, an edition which he prepared in 1879. He was justice of the Michigan Supreme Court during 1864-85, and chief justice in 1868-69. He died at Ann Arbor, Mich., Sept. 12, 1898.

COOLIDGE, CALVIN (1872-), 30th President of the United States, was born at Plymouth, Vt., on July 4, 1872, the son of John and Victoria Moor Coolidge. His ancestry in America was English Puritan, the first Coolidge having settled in Massachusetts Bay Colony in 1630. Calvin's great-great-grandfather removed to Vermont in 1780, and settled down as a farmer. He divided his five farms among his five children; Calvin Coolidge now holds one of the original five tracts. Calvin's father was the proprietor of the general store, and being a shrewd business man, prospered. His mother, a gentle and beautiful woman, was an invalid until her death in Calvin's 12th year.

During the second term of John Coolidge in the state legislature Calvin, then three years old, was taken to the state house in Montpelier and seated in the governor's chair. His education began in his fifth year, and continued at the Plymouth grammar school until Coolidge was 13 years old. He then went to the Black River Academy at Ludlow, and graduated in 1890. The next year he went on to Amherst College, where he was greatly influenced by George D. Olds,anson D. Morse, William S. Tyler, Henry A. Funk, and Charles E. Garman; he was graduated *cum laude* in 1895.

Having decided to take up law, he accepted a clerkship in the office of Hammond and Field in Northampton, Mass., and studied there from 1895 to 1897, when he took the Bar examination and was declared qualified to practice. In 1898 he opened his own office, where he practiced for 21 years.

Already a member of the Republican City Committee, Coolidge was elected in 1898 a member of the Common Council of Ward Two in Northampton. Later he was elected City Solicitor, holding that office until Mar. 1902. The following year he was appointed County Clerk to fill a vacancy, and in 1904 Chairman of the Republican City Committee. The same year Coolidge met Grace Goodhue, and the following year married her.

Elected to the Massachusetts General Court in 1907, Coolidge served two terms, and declined to run for the third one. In 1909 he ran for mayor of the city, and took office in Jan. 1910, thus beginning a public career which lasted until Mar. 1929. Thinking that the Senate of Massachusetts would augment his knowledge of law, Coolidge ran for senator in 1911, was elected, and in 1914-15 served as president of the State senate, where he had rapidly become a powerful influence. In 1914 he served as chairman of the Republican State Committee, and elected every man on his party ticket except the

governor. The next year he decided to run for lieutenant-governor of the state, and was elected with Samuel W. McCall. In this office he had comparatively little authority, and spent most of his time in helping to raise money and energy for the government after the outbreak of the war. Upon the retirement of McCall in 1918 from the nomination for governor Coolidge became the unanimous choice of the Republican party, was elected, and took office in Jan. 1919. In September he faced the problem of a strike carried on by the police of Boston in connection with their membership in the American Federation of Labor. His statement to SAMUEL GOMPERS at this time—"There is no right to strike against the public safety by anybody, anywhere, anytime"—won him nation-wide notice in the press. His attitude in the controversy was used as a campaign issue and he was reelected governor.

In 1920 a national movement, led by Sen. Lodge of Massachusetts, was under way to nominate Coolidge for President in the Republican National Convention, although he would not enter the list of candidates in the primaries. In the convention, after Harding had received the Presidential nomination, the delegates, breaking away from the Senators who were dominating the meetings, stampeded to Coolidge for vice-president. He was elected in 1920, and took office on Mar. 4, 1921. At the death of President Harding on Aug. 2, 1923, Coolidge succeeded to the Presidency and was sworn into office by his father in the farmhouse at Plymouth, Vt. During 1923 and 1924 he attempted to carry out the programs arranged by his predecessor. In June 1924 the Republican National Convention endorsed his record and nominated him for President. Although his son's death a month later prevented his active participation in the campaign, he was elected in November and sworn in the following March.

The administrations of Coolidge, depending greatly upon the departments of treasury, commerce and state, had three watchwords in domestic affairs, economy, reduced taxation and non-participation in labor and industrial disputes. Two precepts in foreign relations were maintained, increasing influence in the Caribbean Sea and progressive efforts to promote world peace.

At home Coolidge brought about the paring of the budget, and substantially reduced the national debt by using Treasury surpluses each year for retiring Government bonds. He supported the reduction of income taxes in 1926, and in 1927-28 favored a comprehensive plan for Mississippi flood control. He vetoed the McNary-Haugen bill as well as the Soldiers' Bonus Bill, and stated that the government was not to interfere in the coal strike of 1927. In the midst of the Teapot Dome oil scandals in 1924 he appointed a commission for an investigation. His adherence to a program which seemed to the people to be to the country's best interest and the increased prosperity of the nation during his administrations won Coolidge great national popularity.

In foreign affairs he urged the adherence of the United States to the World Court, but was not successful in his efforts to secure an agreement with the Powers on the conditions of membership. The failure of the Geneva arms conference in 1927 caused President Coolidge to favor an increase in naval tonnage. Through the appointment of DWIGHT W. MORROW Coolidge helped Secretary Kellogg to reach an amicable agreement with Mexico. In 1927 the Kellogg pact renouncing war was signed by all the Great Powers and by many small nations. The status of international debts was settled with Italy, Belgium, Greece and Yugoslavia through ANDREW W. MELLON.

Having made the cryptic statement, "I do not choose to run for President in 1928," Mr. Coolidge did not even attend the Republican Convention of 1928; he felt sure, however, that the party would support the past administration by nominating HERBERT HOOVER. President Coolidge left the White House on Mar. 4, 1929. He published in the same year *The Autobiography of Calvin Coolidge*. Since returning to Northampton, Mass., Coolidge has engaged in writing short items and articles for newspapers and magazines by way of interpreting social, economic and political current events and trends. He has served on the board of directors of the New York Life Insurance Co. S.D.F.

BIBLIOGRAPHY.—W. A. White, *Calvin Coolidge*, 1925; Calvin Coolidge, *Autobiography*, 1929.

COOLIDGE, CHARLES ALLERTON (1858-), American architect, was born at Boston, Nov. 30, 1858. He graduated from Harvard University in 1881, and studied architecture at the Massachusetts Institute of Technology. He became partner in the firm of Shepley, Rutan and Coolidge, 1886-1914, and senior partner in succeeding organizations. Among the important buildings of which he was architect are those of Leland Stanford Jr. University; the Chicago Art Institute and Public Library; the Law School, Medical School, Hospital and Commons of Chicago University; The Freshman Halls and new Medical Schools of Harvard University; Medical School of Western Reserve University, Cleveland; and new buildings of Rockefeller Institute in New York City. He was made a member of the French Legion of Honor in 1900.

COOLIDGE, WILLIAM DAVID (1873-), American physicist and engineer, was born at Hudson, Mass., Oct. 23, 1873. He studied at the Massachusetts Institute of Technology and at Leipzig University. He joined the staff of the General Electric Research Laboratory at Schenectady, N.Y., in 1905, becoming assistant director in 1908. He became widely known for his invention and application of ductile tungsten, now universally used for filaments in electric lamps, and for his invention of the X-ray tube, known as the Coolidge Tube. A subsequent adaptation of the tube led to the announcement of so-called "death-rays," capable of instantly killing small living organisms and animals. See also X-RAYS: COOLIDGE TUBES.

COOLIDGE DAM, located on the Gila River, Arizona, is noted as the highest hollow concrete dam in the world and the first of the multiple dome type ever constructed. This structure is 249 ft. high above lowest foundation level and 220 ft. above the river bed. The domes have a maximum thickness of about 20 ft. and the supporting buttresses, spaced 180 ft. apart, are 286 ft. wide and 60 ft. thick at the base. The dam creates an irrigation storage reservoir having a capacity of 52 billion cubic feet.

COOLIDGE TUBE, an X-RAY tube characterized by an extremely high vacuum and by a hot filament as the source of the ELECTRONS, developed by Dr. W. D. Coolidge. See also TUBES, ELECTRONIC.

COOLIE TRADE, a term usually referring to the recruitment and importation under contract of unskilled Chinese or Indian laborers for undertakings in countries where there is a shortage of cheap labor. It has also been applied to the indentured labor of Melanesians or Pacific islanders at one time employed on Australian plantations. In order to eliminate or reduce the opportunities for exploitation connected with the trade, the governments or countries involved have in many instances sought by international agreement, as well as by domestic legislation, to regulate the terms and conditions of employment.

COOLING EFFECT, the reduction of the temperature of a gas upon free expansion without the addition of heat from the outside. See JOULE-THOMSON EFFECT.

COOLING SYSTEM, AUTOMOBILE. See HEAT EXCHANGE EQUIPMENT.

COOLING SYSTEMS, refrigerating installations designed to cool the air in an inclosed space. Cooling is accomplished by evaporating water without the addition of heat, or by MECHANICAL REFRIGERATION. The air is passed over water- or brine-cooled surfaces, or through a cold water or brine spray. A term also applied to the apparatus used to keep an INTERNAL COMBUSTION ENGINE at the desired temperature. See also AIR CONDITIONING.

COOLING TOWERS, structures for cooling water by exposing it to large volumes of air. They are generally constructed of wood or metal, though reinforced concrete has been employed in Germany with good economy. They essentially are made up of a series of baffles across which the hot water trickles or flows in thin sheets, meeting the cooler air and giving up heat to it. The circulation of air from bottom to top may be set up either by natural or forced draft, the sides of the tower being enclosed in the latter case. Natural draft towers are sometimes equipped with a chimney to promote the circulation of air. Cooling towers are built in sizes ranging from a few to many feet in height, with about equal horizontal dimensions. Such towers have many applications, one of the widest of which is the cooling of condenser water in power plants, for which the towers are sometimes as much as 80 feet high.

COONTIE, the name given to two small CYADS (*Zamia pumila* and *Z. floridana*), native to southern

Florida. They are low plants with a turnip-like stem, which rarely rises above the ground, and a crown of stiff, pinnately divided leaves in the center of which are borne large fruiting cones. When properly prepared, the starch, which is very abundant in the underground parts of the plant, is the so-called Florida arrowroot, often used for food.

COONTZ, ROBERT EDWARD (1864-), American naval officer, was born in Hannibal, Mo., June 11, 1864. Graduated from the United States Naval Academy in 1885, he served for six years in Alaskan waters. From 1912-13 he was governor of Guam. While commandant of the Puget Sound navy yard in 1917 he was named rear-admiral, and having served as commander of the 7th Division of the Atlantic Fleet, and as chief of naval operations he became admiral in 1919. From 1923-25 he served as commander-in-chief of the United States Fleet, being appointed commandant of the 5th Naval Division in the latter year. He was retired in 1928.

COOPER, SIR ASTLEY PASTON (1768-1841), noted English surgeon, was a pupil of JOHN HUNTER. He began demonstration of anatomy at 21 years of age and was surgeon at Guy's Hospital at 32 years of age. He was a pioneer in surgery of the blood vessels, in experimental surgery, and in surgery of the ear. He was noted particularly for having been the first to ligate successfully such important blood vessels as the common carotid and the external iliac artery. In 1817 he ligated the abdominal aorta and in 1824 did an amputation at the hip-joint. After an operation performed upon King George IV, in 1820, he was made baron.

He was author of books on hernia, injuries of the joints, diseases of the testis and anatomy of the thymus gland. Several tissues in the human body bear his name.

COOPER, JAMES FENIMORE (1789-1851), American novelist, was born in Burlington, N.J., Sept. 15, 1789. His father, Judge William Cooper, moved to his own lands on the Susquehanna River, laid out COOPERSTOWN, N.Y., built the manorial Otsego Hall, and here the future novelist grew up, as a proud young country lord, yet always in the midst of a wilderness which fascinated him. After attending a young gentlemen's school in Albany, N.Y., he went to Yale College, but was expelled after two years for insubordination. Cooper was a United States naval officer from 1808-11, resigning his commission in the latter year to marry Susan Augusta De Lancey. The young couple lived successively at Mamaroneck, N.Y., Cooperstown, Scarsdale, N.Y., and New York City; they were abroad from 1826-33, and thereafter lived mainly at Cooperstown. Cooper turned to writing almost by chance and with disdain at first. His first novel, *Precaution*, published in 1820, was a conventional, badly written book which deservedly failed, but his second novel, *The Spy*, 1821, an early American romance, immediately made him famous. *The Pioneers*, 1823, introduced the remarkable LEATHER-STOCKING series; and *The Pilot*, published the same

year, created a model for succeeding sea stories. *The Last of the Mohicans*, 1826, continued the *Leatherstocking Tales*, as did also *The Prairie*, written while Cooper was abroad, *The Red Rover*, 1828, was likewise written in Europe. Among the novelist's best productions after his return to America in 1833 are *The Pathfinder* and *The Deerslayer*, both in the



"FENIMORE," NEAR COOPERSTOWN, N. Y., THE RESIDENCE OF JAMES FENIMORE COOPER

Leatherstocking series. During the 10 years from 1833-43 Cooper aroused bitter antagonism at home and abroad by his drastic criticisms of institutions, political parties, the press, private persons and even his own townsmen, he was involved in numerous and notorious lawsuits, and for a time public opinion turned completely against him and his novels. Two moderately successful books of this period are *Home-ward Bound*, 1838, and the satirical *Home as Found*, 1838. Cooper's last years were spent at Cooperstown, where he died Sept. 14, 1851.

Cooper's collected works include some 32 volumes. An energetic and prolific romancer, he was not however a subtle or even a careful craftsman, and his writing is frequently clumsy and slipshod. His real significance is found in the *Leatherstocking Tales*, which opened up the way to the American wilderness and the frontier, and in *The Pilot*, which ranks as one of the earliest successful sea stories. An aristocrat himself, Cooper believed in human nobility and integrity, and he embodied these qualities in his Indian characters. He was a man of action, forceful, inspired, often crude, but he was a pioneer in American literature who cleared a path and pointed a direction. See also AMERICAN LITERATURE.

BIBLIOGRAPHY—T. R. Lounsbury, *James Fenimore Cooper*, 1889; *Correspondence of James Fenimore Cooper*, ed. by his grandson, J. F. Cooper, 1922.

COOPER, PETER (1791-1883), American inventor and philanthropist, was born in New York City, Feb. 12, 1791. He received but little schooling because he was needed to assist his father in various trades and at seventeen he was apprenticed to a carriage builder for four years. Subsequently he tried manufacturing cabinet ware, and next established a glue and isinglass factory, which was a great financial success for over 50 years. In 1828 he built iron works at Baltimore and in 1830 produced the first American locomotive engine, called the Tom Thumb because of

its diminutive size. He supplied money to lay the Atlantic cable and was for a while president of the New York, Newfoundland and London Telegraph Co. In 1857-59 he founded and endowed Cooper Union, New York, to provide for others the educational opportunities he had not enjoyed. He died in New York City, Apr. 4, 1883.

COOPER, SIR POPE ALEXANDER (1848-1923), Australian statesman, was born at Willeroo, Lake George, New South Wales, May 12, 1848. He attended Sydney University and London University, and became a member of the bar in London. Returning to Australia in 1874, he held many important offices as member of the Legislative Assembly for Bowen, attorney general, and judge of the Supreme Court. In 1904 he was created a Knight, and four years later was made K.C.M.G. He died in Aug. 1923.

COOPER, WILLIAM JOHN (1882-), American educator, was born Nov. 24, 1882, at Sacramento, Cal. He graduated from the University of California in 1906. After teaching in California schools for a number of years, he made a survey of Oakland schools, 1915-18, then served as district superintendent of schools, at Piedmont, Cal. Cooper was city superintendent of schools, San Diego, in 1926, and superintendent of public instruction of the State of California in 1927. In 1929 he was appointed United States Commissioner of Education at Washington, D.C.

COOPERAGE, a comprehensive term applied to barrels, kegs, tubs, and pails. Barrels and kegs usually have bulging sides, and are divided into tight barrels for liquids and loose barrels for dry and loose contents. Tight barrels have staves $\frac{3}{4}$ to 2 in. thick, scarfed at the ends, while loose barrel staves are $\frac{1}{2}$ in. thick or less. The barrel is held together with wooden or metal hoops or bands, and has a sturdy construction which offers maximum strength with convenient handling. Barrels are occasionally made cylindrical from veneer. Pails and tubs were formerly made of wood, but have now been largely replaced by metal and fiber ware.

COOPERATION, in industry, consists of three quite distinct social reform movements with differing philosophies. The first of these is consumers' co-operation, which proposes the gradual abolition of the capitalistic system of production and distribution in favor of a federation of consumer-owned and consumer-operated enterprises, extending from small retail stores to vast producing units. The second type is the producers' cooperative in which workers join to own and control, for their mutual benefit, the factory or enterprise in which they work. Integral cooperation is the third form. Under this plan, colonies of workers, largely self-sufficing in character, come together as voluntary groups; the intention being thus to withdraw from the complexities of large scale capitalistic organization to what is considered a more healthy and workable social unit.

Of these three, the first has made the greatest strides. Blending as it does the strong urge for self-

advancement with a highly practical mechanism for mutual aid, it has expanded, particularly in Europe, until it has become a prominent factor in industrial life with a membership of over 50,000,000 consumers. In Great Britain, the idea took root in 1844 with the ROCHDALE PIONEERS. The British movement now has about 5,000,000 members. Other countries, especially Germany, Scandinavia, Switzerland and Soviet Russia, have notable consumers' cooperative developments.

Not only are the familiar retail enterprises operated by cooperatives; but their efforts have also brought them into large housing construction projects, especially in Germany, into banking and credit unions, into insurance and recreation, into restaurant operation, into milk distribution, into health protection, and into many types of productive enterprise. The Cooperative Wholesale Society of England is the largest importer of tea, grain, butter, sugar and dried fruits in Great Britain. It owns coal mines, tea plantations, woolen mills, shoe factories and a multitude of other enterprises. The American movement, though less developed, embraces 700,000 members who buy cooperatively \$300,000,000 of goods a year through cooperative channels. The Cooperative League (New York) is the federation to which 300 of the 1,800 American societies are affiliated, and which in turn is connected with the International Cooperative Alliance (London). The consumers' cooperative movement is held by its sponsors to be a democratic substitute for CAPITALISM. Voting power is equal, regardless of share holdings, a fixed interest is paid on stock, and insistence is laid upon expanding the membership through education. The Belgian system of allocating profits to social purposes, and the Rochdale system of rebating purchase dividends are familiar types.

Cooperative theorists disagree as to whether their movement is compatible with SOCIALISM. Sidney and Beatrice Webb hold that the cooperative movement should limit itself to the field of supplying of household requisites, to international trade, and to the furnishing of those products which state enterprise is ill-equipped to produce. J. P. Warbasse holds, on the contrary, that cooperation should embrace all industry and agriculture, reducing the functions of the state to a minimum. In the highly developed Russian cooperative system, the heavy industries and public utilities have not been entered by the Cooperatives.

Producers' cooperation has had a checkered development, especially in the workshops of Britain, France, and America. Considerable impetus was given this movement after the middle of the 19th century, by a group of Christian Socialists, led by Kingsley, Maurice, and Hughes. It was felt that employee ownership and control would emancipate labor from the profit system and would bring joy in work. But few remnants of the movement remain, failure having resulted either from lack of discipline of the employed workers who were ill-fitted to be their own employers, or from spectacular success

which made them unwilling to admit new partners on the same terms as those on which they entered—thus making the organization capitalistic in character. The Columbia Conserve Company of Indianapolis is the most vigorous American Producers' Cooperative. Soviet Russia has inaugurated a modified form of Producers' Cooperative in its rapidly developing *artels* in handicraft enterprise and in its agricultural collectives.

Integral cooperation, the third type, has a long ancestry. It was practiced under pioneer conditions in many countries. But few American attempts have survived. These typically have involved a strong religious tie. Since integral cooperation is generally organized on anarchistic or communistic principles, see ANARCHISM and COMMUNISM. C. E. W.

BIBLIOGRAPHY.—J. P. Warbasse, *Cooperative Democracy*. Sidney and Beatrice Webb, *The Consumers' Cooperative Movement*; Charles Gide, *Consumers' Cooperation Societies*.

COOPERATIVE BANKING. A cooperative society is "a voluntary association in which people organize democratically to supply their needs through mutual action, in which the motive of production and distribution is service, not profit," as defined by J. P. Warbasse, in *Cooperative Democracy*. A cooperative bank is one organized on that principle. A cooperative bank differs from other banks in that it accumulates its capital exclusively to members, with all earnings reverting to members as dividends or surplus or both, operating without exterior invested capital and stressing primarily banking service for members rather than earnings from various sources, which earnings are divided primarily among investors who own the capital stock of the bank. There are three distinct types of cooperative banks: cooperative investors' associations (example, the savings and building-loan associations); the people's banks; cooperative borrowers' associations (example, the Raiffeisen village bank). The three types serve in distinctive ways. The building and loan associations stress savings and loans to members to help them acquire homes; the people's banks serve primarily the credit needs of small trades people; the Raiffeisen banks protect wage workers from usurious charges by private money lenders, and also serve rural groups. The building and loan associations originated in England early in the 19th century and spread to the United States, where they constitute the primary manifestation in cooperative banking. Alphonse Desjardins organized the first Raiffeisen bank in North America at Levis, Quebec, in 1900, and subsequently organized over a hundred similar banks, designating each bank *la caisse populaire*. Massachusetts enacted the first law in the United States authorizing such banks in 1909, designating them credit unions. Similar laws have since been enacted in 31 additional states. The earliest cooperative banks were organized in Germany by Friedrich Wilhelm Raiffeisen, whose experimentation originated at Flammersfeld in 1847 and was perfected at Heddesdorf in 1864, and Herman Schulze-Delitzsch, whose first society was or-

ganized at Eilenberg in 1850. To these beginnings may be traced the present world-wide development of this type of cooperative banking. R. F. B.

BIBLIOGRAPHY.—J. P. Warbasse, *Cooperative Democracy*; D. S. Tucker, *The Evolution of People's Banks*.

COOPERATIVE INSURANCE, insurance issued by mutual companies composed of members combined for the purpose of insuring the life risks of the various members. Such companies are usually membership corporations without capital stock. Profits or losses are determined at stated periods and are either distributed in the form of dividends to policy holders, after setting aside a reserve; or assessed against them. The laws of different states limit the amount of losses that may be assessed, to from one to ten times the amount of the original premium.

COOPERATIVE MARKETING, a plan most commonly applied to agriculture by which individual proprietors join in an association to carry on one or more marketing functions. The most common functions include the assembling, grading, packing and selling of the product. Outstanding among marketing groups organized on this basis is the California Fruit Growers' Exchange which cooperatively markets three-fourths of the California orange crop. The plan has also been successfully placed in operation in such diverse fields as marketing of cranberries, milk, raisins, apricots, potatoes, prunes, apples, walnuts and, to a considerable extent, the cereal crops.

The national and most of the state governments have encouraged the movement by passing laws enabling incorporation on a liberal basis. Ordinarily the requirements include that the cooperative be on a limited dividend basis; that each participant be allowed one vote irrespective of stock holdings, and that the cooperative undertake the bulk of its business with its own members who are, themselves, bona fide producers.

The prime economies achieved come from the attainment of a volume of business, from an improved bargaining position, and from the education of members in marketing practices. A weakness of the plan has been its failure effectively to control the acreage and output of the individual participants and of those outside the organization, thus creating a market surplus whenever an especially advantageous price has been obtained. Other difficulties include lack of trained management, a tendency to excess overhead costs caused by frequent over-investment in plant equipment, and a failure of elements in the membership to comprehend the essential purposes of the movement.

This plan of marketing has secured widespread adherence abroad, especially in Denmark. Its rise in the United States has been greatest since the World War. Cooperative marketing is now favored by financing at low rates through governmental agencies, by lowered taxation, and by the supplying of governmental experts to aid in organizational and administrative problems.

Though many farmers' cooperatives undertake the

joint function of buying supplies for their members and marketing their products, the spirit of the cooperative marketing movement is generally of a purely business sort—thus differing widely from the consumers cooperative movement which has, as its program, the abolition of the profit system.

According to the U. S. census of agriculture for 1920 and for 1930, cooperative marketing was carried on to some extent in every state. The number of farms reporting sales through farmers' organizations for the year 1919 was 511,383, with total sales amounting to \$721,983,639. For 1929 the number of such farms was 691,895, with total sales of \$892,481,491. Owing to the decline in prices the increase from 1919 to 1929 in volume of products handled was much greater than the increase indicated by their value. In 1929 the eight states leading in cooperative marketing, with value of products so distributed, were California, \$153,072,690; Minnesota, \$105,965,586; Iowa, \$74,635,414; New York, \$52,623,182; Illinois, \$48,993,674; Wisconsin, \$42,544,056; Kansas, \$36,396,390; and Washington, \$33,338,231. The foregoing states distributed almost one-half (49.3%) of the farm products sold in the United States by cooperative marketing.

The purchases of supplies through farmers' organizations increased in value from \$84,615,669 for 1919 to \$125,048,597 in 1929. C. E. W.

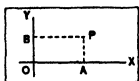
BIBLIOGRAPHY.—Mears and Tobriner, *Principles and Practices of Cooperative Marketing*; F. E. Clark, *Principles of Marketing*.

COOPERSTOWN, a village in north-central New York, the county-seat of Otsego Co., 80 mi. west of Albany, beautifully situated at the foot of Otsego Lake where the Susquehanna River emerges from it. Pop. 1930, 2,909. This quiet little town, once the site of an Indian village, is intimately associated with JAMES FENIMORE COOPER, whose father, Judge William Cooper, moved there with his large family from Burlington, N.J., in 1790, when the future novelist was but a year old. Cooper wrote many of his finest tales while living at Otsego Hall, the stone mansion finished by Judge Cooper in 1799, and, dying in 1851, was buried here. The site of the Hall, which burned in 1852, is now Cooper's Grounds, a public park containing memorials to the creator of LEATHERSTOCKING. Cooperstown was the home of Col. A. Doubleday, inventor of BASEBALL. Pop. 1920, 2,725; 1930, 2,909.

COOPER UNION, an institution founded by Peter Cooper in New York City in 1859 to provide an education in science and the arts for the working classes. There are no denominational restrictions, and all classes are free. The most important educational work of the institution is done in the evening classes. Both the reading rooms and library are open to the public. With other endowments added to the original fund, the school has been able to provide laboratories of the most advanced type. In addition to the lecture courses, the institution maintains night schools of art, engineering, a school of technical science, a woman's art school, stenography and typewriting school, a telegraphy school, and classes in elocution, oratory and

debate. It has productive funds amounting to \$5,520,791. There is a museum, an art gallery and a library of 60,634 volumes. In 1930 there were 1,088 students enrolled with a faculty of 100, headed by Director R. Fulton Cutting.

COORDINATES, the bases used in geometry for locating points, lines, or surfaces. These coordinates may be points, lines, surfaces, or various combinations of these three. The most commonly used coordinates are explained below. In geography a point on the earth's surface is located by its latitude, *PA*, and its longitude, *PB*. In analytic geometry a point is located in the same way. The latitude *PA* is then called the ordinate of *P*, and the longitude *PB*

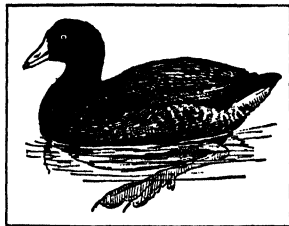


(or *AO*) is called the abscissa. The ordinate and abscissa together are called the coordinates of the point.

There are various other methods of locating the point. For example, the axes *OX* and *OY*, corresponding to the equator and the prime meridian, may be oblique. See ANALYTIC GEOMETRY.

COOSA RIVER, a headstream of the Alabama River, formed by the confluence of the Etowah and Oostanaula rivers at Rome, Ga. It flows westward into Alabama and thence southwestward until it combines with the Tallapoosa about 10 mi. northeast of Montgomery to join the Alabama River. The Coosa is about 350 mi. long and drains an area estimated at 4,006 sq. mi. It flows through the picturesque mountain region of the southern extremity of the Appalachian system which is a district rich in iron ore deposits. Below Greensport, Ala., the river has a deep fall which furnishes abundant water power for manufactures. It is navigable from Rome to Greensport and will be navigable throughout upon the completion of a series of locks and dams.

COOT, a genus (*Fulica*) of marsh birds belonging to the rail family, called also mud hen, found in reedy marshes almost throughout the world. They are somewhat duck-like in appearance, with blackish or slate-colored plumage and lobed toes, and they swim and dive with great facility. The American coot (*F.*



G. M. SUTTON. "BIRDS OF PENNSYLVANIA,"
J. HORACE McFARLAND CO. COPYRIGHT

AMERICAN COOT

americana), found practically throughout North America, Central America and the West Indies, is about 15 in. long, with an ivory-white bill. It feeds upon various aquatic plants and animals and in com-

pany is very noisy, uttering loud cackling notes; it nests among the reeds, in fresh water marshes, laying 8 to 15 finely speckled buff-colored eggs. The coot is considered a game bird but its flesh is somewhat inferior to that of a duck.

COPAIBA, a genus of trees of the pea family native to tropical America and Africa, several species of which yield valuable resins. From the South American copaiba tree (*C. officinale*) is obtained the oleo-resin known as balsam of copaiba, used in medicine. Hard resins known as copals, used in making varnishes, are produced by various African species.

COPAL, the commercial name for a number of fossil resins obtained mainly in Africa and used in the manufacture of VARNISH. Angola Copal is a soft fossil gum, pale in color and semi-transparent. Sierra Leone copal, produced by a leguminous tree, is collected in the manner as is turpentine, and is used in the finest French varnishes. Borneo, equatorial Guinea, the Belgian Congo and the Philippine Islands also supply copals.

COPE, EDWARD DRINKER (1840-97), American palaeontologist, was born at Philadelphia, July 28, 1840. He was professor of natural sciences at Haverford, 1864-67. In 1872 he became palaeontologist of the Geologic and Geographic Survey of the Territories, and in 1889 professor of geology and zoology at the University of Pennsylvania. He died at Philadelphia Apr. 2, 1897.

COPE (Latin *Cappa pluviale*, rain cape), a liturgical garment, in ancient times worn at processions as a protection against rain. At present it is a semi-circular cloak falling in folds to the feet, fastened in front at the neck with a metal clasp and, like the CHASUBLE, usually made of costly silk and velvet with

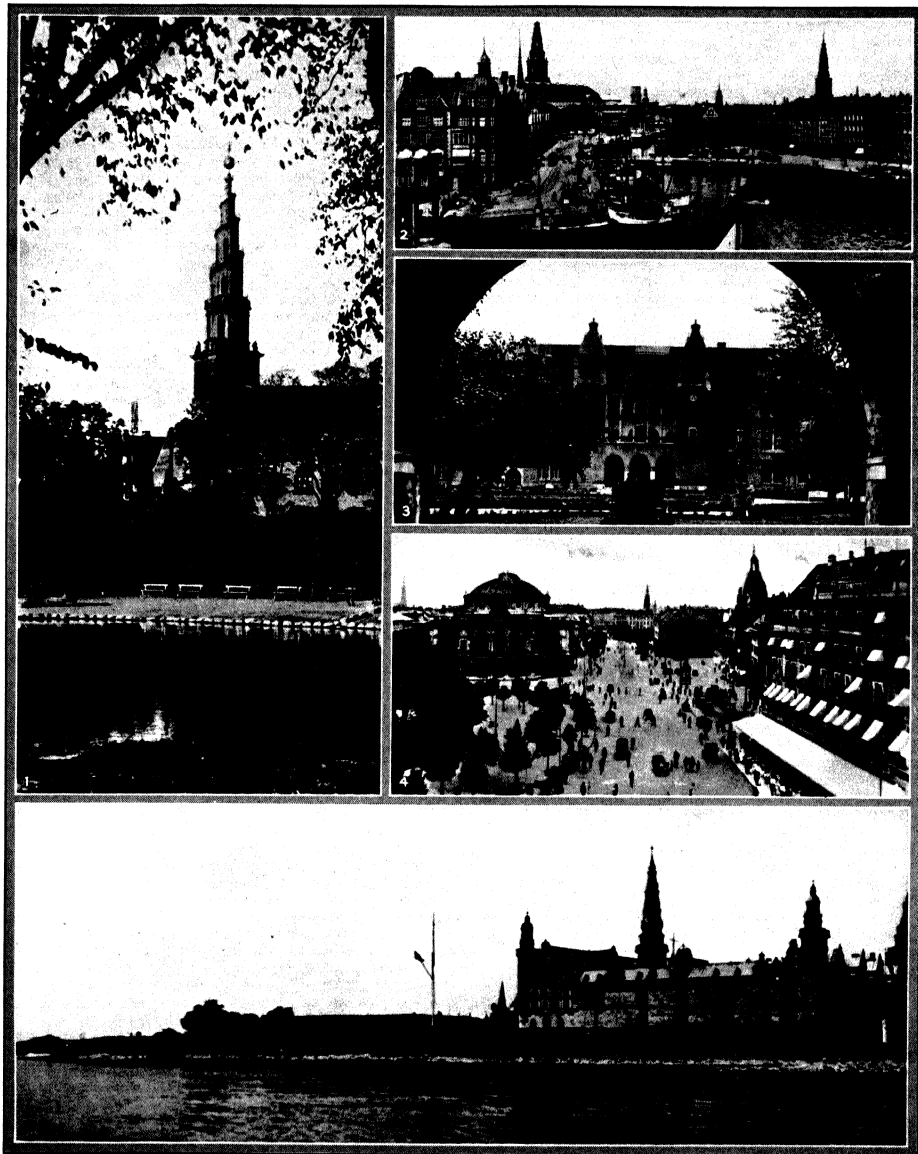


COURTESY M. M. OF ART

SPANISH COPE OF VELVET (15TH CEN
TURK)

rich embroidery. It is worn at services with music and incense, other than the Mass, at processions, dedications, solemn vespers and benediction. *Cappa pluviale* also designates the coronation mantle belonging

COPENHAGEN



COURTESY SCANDINAVIAN TRAVEL BUREAU, N. Y. C.

COPENHAGEN—THE CITY OF BEAUTIFUL SPIRES

1. Our Saviour's Church, Copenhagen. A circular stairway leads to the top of the spire. 2. Canal around Cristiansborg Castle, Copenhagen. 3. The Royal Library in the

capital city. 4. The Royal Square in Copenhagen. The opera is seen at the left. 5. Kronborg Castle, Elsinore, the scene of Shakespeare's *Hamlet*.

to the imperial insignia of the earlier German emperors, now in the Hof Museum at Vienna.

COPEHAN, a North American Indian linguistic stock, sometimes called Wintun, which formerly occupied an extensive area in California from Suisun and San Pablo bays on the south to Mt. Shasta and the territory of the Shasta on the north. The stock was divided into two sub-groups, Patwin and Wintun, each of which included numerous smaller divisions.

COPELAND, CHARLES TOWNSEND (1860-), American educator and author, born at Calais, Me., Apr. 27, 1860. He graduated from Harvard in 1882, and joined the English department there in 1893, becoming Boylston professor of rhetoric and oratory in 1925. Copeland has contributed articles on literary topics to the *Atlantic Monthly* and is the author of *Life of Edwin Booth*. He was the editor of *The Copeland Reader* and other books, and with H. M. Rideout, has written and edited a number of other works.

COPENHAGEN, the capital of Denmark, located on the eastern coast of Zealand, the country's most important port and commercial and intellectual center, and the largest city in Scandinavia. Founded in the 12th century by Absalon, Bishop of Reskilde, the city grew rich by its trade, and was chosen capital of the kingdom in 1443. To-day Copenhagen is an important city commercially and serves as the headquarters of mostly all the steamship owners of Denmark. The city owes much of its architectural appearance to two kings, Christian IV (1588-1648) under whose patronage flourished the distinctive style of architecture known as Danish Renaissance, and Christian V (1670-99) who widened the city streets and encouraged the use of stone in building. Many of the picturesque old houses still remain standing, the Exchange, the Rosenberg Palace, and the warehouses along the quays. The most celebrated structure is the Town Hall built in 1804-1903 in the Danish Renaissance style of architecture. Trinity Church is famous with its curious round tower, up whose winding passage Peter the Great is said to have driven a carriage and four. The National Museum contains one of the finest existing collections of prehistoric remains; that of the Bronze Age being especially noteworthy. Most of the original work of the sculptor Thorvaldsen is housed in a special museum. The general museum of ancient and modern sculpture is also noteworthy and the university founded in 1479 has a famous library. Copenhagen exports dairy products, meat, horses, and cattle. Not essentially an industrial town, two of its manufactures are world-famous: the porcelain made under royal patronage, and the silverware privately manufactured. Pop. 1930, 771,953.

COPENHAGEN, BATTLE OF, 1801, a naval battle fought between British and Danish warships near Copenhagen. The British wished to break the armed neutrality existing between Denmark, Sweden, Russia and Prussia, as well as to enforce their claim to the right of search. The British fleet arrived on

Mar. 21, with Sir Hyde Parker in command, and Nelson, second in command. Nelson saw that the best plan lay in attacking the Danish fleet from the south and, by manoeuvring his own ships through the Outer Deep, was able to destroy the majority of the Danish ships. The victory forced Denmark to withdraw from the Northern Conventions and led to the collapse of the Neutrality.

COPERNICAN SYSTEM, that conception of the solar system in which the sun is supposed to stand still in the center while the planets move around it in circles. It was named after NICOLAUS COPERNICUS and, with slight corrections and additions, still holds to-day. See ASTRONOMY.

COPERNICUS, NICOLAUS (1473-1543), German-Polish astronomer, was born at Thorn, Poland, Feb. 19, 1473. He was educated under the guidance of his uncle, the prince-bishop of Frauenburg, and entered the university of Cracow where he made the acquaintance of the astronomer Johann Muller, better known as Regiomontanus. From 1496 to 1500 he studied at Bologna, and in 1500 became professor at Rome. In 1501 he went to Padua, and in 1503 was awarded the degree of Canon Law by the University of Ferrara. In 1505 he returned to Poland as medical attendant to his uncle, upon whose death he became canon of the diocese. This placed upon him many onerous duties of judicial, fiscal and administrative character, as well as involving him in a number of political and religious struggles.

His great contribution to human knowledge lies in his definite formulation of the idea that the earth is not immobile in the center of the universe, but rotates upon its axis, and revolves around the sun, in company with all the other planets. This conception is known as the Copernican system. He seems to have arrived at these thoughts as early as 1507, and actually completed his work by 1530, but for religious reasons he withheld publication until 1543. The first printed copy of his great work *De Revolutionibus Orbium Coelestium* (On the Motions of the Heavenly Bodies) reached him at Frauenburg a few hours before he died, May 24, 1543.

COPHETUA, KING, a legendary king of Africa whose love for a beautiful and virtuous beggar-maid, Penelophon, is the subject of an old ballad published in Percy's *Reliques*, 1765. TENNYSON made use of the legend in his poem *The Beggar Maid*.

COPLEY, JOHN SINGLETON (1737-1815), American painter, was born at Boston, Mass., July 3, 1737. He received some instruction from his stepfather, Peter Pelham, and at the age of 17, produced his first grouped picture, an allegorical study of Mars, Venus and Vulcan; from this time he was recognized as a painter. After a successful career as a portrait painter in Boston, Copley settled in London, 1774, and became a notable painter of historical scenes. He was elected to the Royal Academy in 1779, presenting on admission his *Tribute Money*. His fame in England was established by *The Death of the Earl of Chatham*, now hanging in the Na-

tional Gallery, London, with *The Death of Major Pierson*. Copley's best known American portraits are those of John Adams and John Hancock. Others are of Samuel Adams, Gen. Joseph Warren, Mrs. Warren and John Quincy Adams, in the Boston Museum of Fine Arts; and of Rev. Daniel Greenleaf, Rev. William Smith, Mary Sherburne Bowers and Mary Storer Green, in the Metropolitan Museum, New York. Copley died in London, Sept. 9, 1815.

BIBLIOGRAPHY.—F. W. Bayley, *The Life and Works of John Singleton Copley*, 1915.

COPPÉE, FRANÇOIS EDOUARD JOACHIM (1842-1908), French author, was born in Paris, Jan. 12, 1842, and educated at Lycée Saint-Louis. His fame as a poet was established with the publication in 1867 of *Le Reliquaire*, the first of many volumes of verse. His first poetic drama, *Le Passant*, appeared in 1869, and his first prose story in 1875. He was archivist to the Comédie Française, 1887-84. In 1884, he was elected to the French Academy. Coppée was particularly the poet of humble folk, whose lives he depicted with tenderness and understanding. He died in Paris, May 23, 1908.

COPPER, one of the earliest known metals and also one of the purest produced in large commercial quantities. It is tough and malleable, having a characteristic red color and a bright metallic luster. Its melting point is 1083°C; atomic weight, 63.57; chemical symbol, Cu.

Copper slowly becomes dull in dry air, but in moist air, in combination with carbon dioxide and sulphur dioxide, an olive green coating or patina is formed. When heated to redness with access to air or other oxidizing agents, a dark colored scale, consisting principally of cuprous oxide, forms on the surface. Copper slowly dissolves in weak acids in the presence of air, but more rapidly in nitric acid, aqua regia and hot concentrated sulphuric acid. In the presence of air, it is soluble in ammonia with a characteristic dark-blue solution. About 80% of the world's production of copper comes from North and South America.

Metallurgy. The modern smelting and refining of copper is distinctly an American development. The requirements of American industry for a satisfactory material that can be fabricated by mass production methods is responsible, in a measure, for the present high quality of copper. Annealed copper has a minimum tensile strength of 30,000 lbs. per sq. in. and varies from that to 60,000 lbs. per sq. in. according to the amount of mechanical work upon the metal and its composition. The elongation varies from 38% for the soft to 3% for the hard metal. The minimum electrical conductivity of the soft is 98% International Annealed Copper Standard at 20°C. The electrical industry consumes half the copper used in the United States, other industries using large amounts are mills rolling copper and brass tubes and sheets, and brass and bronze foundries.

Copper Alloys. Copper readily forms alloys with zinc, tin, aluminum, nickel, silicon, cadmium and silver. Lead, antimony and bismuth do not alloy with

copper and may be harmful to its use. Copper-zinc alloys (*see BRASS*) are perhaps the most important copper alloys, and next in importance are the copper-tin (*see BRONZE*). Copper-silicon alloys are used where materials with high strength and resistance to corrosion are desired. Nickel alloys (*see GERMAN SILVER*) vary in nickel content up to 25%, the most important alloy containing 65% copper, 17% zinc and 18% nickel. They are used for silver plated articles and plumbing fixtures. Silver solders are alloys of copper, zinc and silver. The copper-cadmium alloys up to 2% cadmium are used for electrical transmission purposes where high strength and good electrical conductivity are required. *See also GUN METAL; ALLOYS, HIGH TEMPERATURE.* W. H. B.

COPPERAS, a common name for green vitriol or ferrous sulphate, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$. Copperas has a bluish-green color and a peculiar astringent taste. For commercial purposes it is generally made by the oxidation of iron pyrites. It is used in dyeing black, in making ink, in photography as a developing agent, and, dissolved in water, as a disinfectant.

COPPER BUTTERFLY, a term applied to certain species of small butterflies of the family *Lycaenidae*. Distinguished from other members of this family usually "by their orange-red and brown colors, each with a coppery tinge, and conspicuous brown markings." The American copper (*Heodes hypophlaeus*) is the most common species in the north-eastern states and Canada. In the West and Middle West a somewhat larger species, the bronze copper (*H. thoe*), occurs commonly.

COPPERHEAD, a popular name for a species (*Agkistrodon*, or *Trigonocephalus contortrix*) of pit viper, related to the water moccasin and, less closely, to the rattlesnake. It is usually small, seldom being much over 3 ft. in length. However, in deadliness, it is second only to the rattler among American snakes. The head is bright copper; the body copper-brown marked with darker brown. It is found in woods, especially among mountains, from New England to Texas. This snake feeds largely on mice. Most of its hunting is done at night, the day being spent in hiding. It does not bite unless disturbed or frightened, but when it strikes it does so without warning. The eggs are retained within the mother's body until the young, seven to nine in number, are ready to hatch.

COPPERHEADS, northern men opposed to the continued prosecution of the AMERICAN CIVIL WAR. This name, which sprang into wide use in 1863, derived its aptness from the belief that the copperhead snake gives no warning before it strikes. The Copperheads split the Democratic party in the northern states into two divisions, the Peace Democrats and the War Democrats. CLEMENT LAIRD VALLANDIGHAM of Ohio was the most prominent Copperhead.

COPRA, the dried, broken-up kernel of the coconut from which coco-nut oil is extracted. It is estimated that 500 lbs. of copra are obtained from 100 nuts. The nuts are split open with a machete and

the kernel is removed, broken into smaller pieces and sun-dried. While coco-nut oil is imported from the East Indies, West Indies, Philippines and other countries, most of the imports are in the form of copra, which is processed in this country.

Copra is the only salable produce of many of the small atoll islands of the East Indies. It is collected by traders who go from island to island, buying small lots until their ships are filled. Much of this trade is carried on by Germans and the bulk of the copra collected goes to Europe. Enormous amounts of copra are imported into the United States, the greater proportion coming from the Philippine Islands. Copra exports from these Islands in 1928 were valued at 45,084,682 pesos, of which 80% went to the United States. Exports of copra meal from the same country in 1928 were valued at 5,772,274 pesos, 74% going to Germany. The total world production was estimated at 4,500,000,000 lbs., worth \$225,000,000.

COPTIC, the Arabic term for EGYPTIAN, applied to that language and its literature as written from the 3rd century onward by the Christians of Egypt in a script derived from the Greek alphabet augmented by Demotic letters. This Christian literature flourished until at least the 13th century; and Coptic was still generally spoken in the 15th, but became extinct in the 17th, being replaced by ARABIC. Its dialects were the Bohayric of the Nile Delta, the language of the texts used to this day in worship; the Saïdic of Upper Egypt, employed for literature at an earlier date; and those of Akhmim and the Fayyum, written during a brief period. M. C.

BIBLIOGRAPHY.—G. Steindorff, *Koptische Grammatik*, 3d ed., 1930.

COPULA, any form of the verb "to be" or of its equivalents as a mere connective between the subject and the predicate as distinct from its use to indicate actual existence or state, as *the man is good* in contrast to *the man is good* (contradicting *the man is bad*). As these examples imply, the copula is essentially unaccented. The copula is found only in what were originally "nominal phrases," i.e., those composed simply of subject and predicate, without any verbal idea, the copula being introduced merely for the sake of analogy with the "verbal phrase" whose complete sense requires a verb, as *the man builds the house*. The pure nominal phrase, i.e., without the copula, is common in many linguistic families, including INDO-EUROPEAN, especially in its older stages, as SWAHILI *simba mui*, "the lion (is) bad," HUNGARIAN *az ég kék*, "the sky (is) blue," Hebrew *ish rab*, "the man (is) great," Sanskrit *tvaṁ vārunas*, "thou (art) Varuna, Old Irish *maith in-fer*, "good (is) the man," Russian *domū novū*, "the house (is) new."

COPYING MACHINES, machines for making duplicates of manuscript, drawings, etc. As distinguished from MANIFOLDING MACHINES, copying machines produce duplicates in a different "set up" from that in which the original is made. Special forms of cameras which make direct photographs of

the original, and blue printing machines are commonly used.

COPYRIGHT, the right granted by law to writers, musicians and artists to exclusive publication rights of their works for a period of 28 years, with the privilege of renewing the right for 14 years. Copyrights are granted upon application and with the deposit, in the Library of Congress, of a copy of the title page of the work at date of publication and of two printed copies of the work not later than ten days after that date. Works so copyrighted must be published with a notice of copyright. Copyrights may be secured for other than original works; namely, for translations, additions and corrections, and compilations of another's work and for abstracts and newspaper reports of speeches, and debates. Copyright protects the form, arrangement and manner of expression in works, but not the ideas. Original jurisdiction for copyright suits rests with the circuit courts. In establishing international copyright relations the United States has entered into special agreements with the other leading countries. See also LITERARY PROPERTY.

COQ D'OR, LE, an opera in three acts, with prologue and epilogue, by N. A. RIMSKY-KORSAKOV, libretto based on a Pushkin poem by Bielsky; première, Moscow, 1910. The work is Rimsky-Korsakov's last most successful opera, notable for the wit and color of its orchestration by the foremost master of instrumentation in Russia. When produced in Paris, London and New York under the direction of Fokine, each of the leading rôles was taken by two performers, the mute actors and dancers occupying the stage proper, and the singers being seated on both sides.

Worn out by the cares of state and oppressed by his corpulence, King Dodon finds great difficulty in fixing his attention on the military problems confronting him. The enemy is invading his kingdom. Unfortunately his advisers cannot agree upon a solution of the difficulties and the council hall becomes the scene of a terrific uproar. At this juncture the king's astrologer arrives, bearing a golden cock which has prophetic powers and will crow whenever danger threatens. Overjoyed, King Dodon at once goes to bed, safe in the thought that the golden cock will crow from the palace steeple if the enemy advance. Suddenly the king is awakened by a wild crowing. Leaping out of bed, he goes forth to battle with the enemy. After suffering partial defeat he comes upon a tent whence emerges a beautiful woman. Mocking his awkwardness, she induces the king to dance so violently that he falls to the ground in exhaustion, whereupon she agrees to marry her panting victim. King Dodon and his bride now return home, escorted by a triumphal procession. But the queen soon grows bored with her fat husband, the astrologer demands payment for the golden cock in the form of the queen herself, the king kills the astrologer for his impudence, the golden cock kills the king for that murder, and then the scene disappears in a great thunderclap, leaving only the astrologer to explain that the drama just enacted was a fairy tale.

COQUELIN, BENOÎT CONSTANT (Coquelin aîné) (1841-1909), French actor, was born at Boulogne-sur-Mer, Jan. 23, 1841. He was trained at the Conservatoire which he left in 1860 to make his initial public appearance at the Théâtre-Française, playing a small part in the *Dépit amoureux* of Molière. During 1864-86 he was a leading member of the French state theater, appearing with outstanding success as the lead in *Gringoire*, 1867, *Paul Forestiere*, 1871, *L'Etrangère*, 1876, and other plays by classical and contemporary dramatists. His expertness in the creation of comedy was unsurpassed in his time. In 1900-01 he made a tour of the United States with SARAH BERNHARDT. Coquelin died at Paris, Jan. 27, 1909.

COQUILLA NUT, the fruit of a tall South American palm (*Attalea junifera*). The rich brown, oval kernels, 3 to 4 in. long, exceedingly hard in texture, are used like vegetable ivory in turnery and making various articles, as buttons, umbrella handles and door knobs. The tree also produces the valuable Piassaba fiber extensively used for cordage.

COQUILLE, an Athapascan-speaking American Indian tribe, probably now extinct and once living in villages on upper Coquille River in Oregon.

CORAL GABLES, a city on the southeastern coast of Florida, in Dade Co., situated 5 mi. west of Miami, comprising both mainland and several islands at the mouth of Biscayne Bay. Two railroads serve the city, and there are also waterways and canals connecting with Biscayne Bay. Coral Gables is a noted winter resort. Originally a real estate development, it is built along Spanish and Moorish styles of architecture. Coral Gables was incorporated in 1925. Pop. 1930, 5,697.

CORAL ISLAND, a term sometimes erroneously applied to a tropical or subtropical oceanic island, fringed with living coral. When rightly used, the term designates a low island rising little more than a dozen feet above sea-level, composed of coral sands, and broken coral, piled by the waves upon the submerged limestone platform of a ring-shaped atoll, or on a portion of a barrier-reef. The foundation reef represents the accumulated skeletal remains of myriads of coral-polyps and other lime-secreting organisms. The Florida keys are coral islands rising on a submerged reef. Many palm-grown coral islands of the Pacific archipelagoes are noted for their beauty.

CORAL REEF, a shoal of dead or living coral submerged except at very low tide. Such coral formations abound in clear, shallow waters along tropical coasts. The reef mass consists of a platform of white limestone formed of the remains of myriads of lime-secreting organisms. Upon this base living coral grows. Reefs rising relatively close to shore, as along the southern coast of Florida, are called fringing reefs, those offshore, barrier reefs. Circular reefs enclosing lagoons are known as ATOLLS. The Great Barrier Reef paralleling the coast of Australia for 1,200 miles, at a distance of 20 to 30 miles from the mainland, is the greatest of coral reefs.

CORAL-ROOT (*Coralorrhiza*), the name given to a group of parasitic or saprophytic orchids with peculiarly branched, knotty, underground stems resembling coral. There are about 15 species growing in moist shady places in the Northern Hemisphere, some 10 of which occur in the United States. They are rootless herbs with brownish or purplish stems, which bear sheathing scales instead of leaves, and terminal clusters of small lurid flowers.

CORALS, broadly speaking, coelenterate animals which form skeletons of coral—a non-living support composed chiefly of carbonate of lime. The majority of corals belong to the class of flower animals (*Anthozoa*), and it is to them that this article is confined. They occur in great profusion in the tropics and subtropics, where their skeletons are often numerous enough to build coral reefs and islands, but some corals are found in temperate and arctic seas. Generally they live in shallow water. Reef building forms are seldom found in water more than 180 ft. deep; a few species, however, inhabit the deep sea.

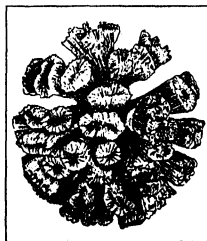
Flower animals are coelenterates which have only the polyp form. They are never jellyfish (*medusa*). The most familiar of them are the sea anemones, which are not corals because they have no skeleton. Essentially a coral polyp, or a sea anemone, is a more or less cylindrical animal of lowly organiza-

tion, that has a mouth surrounded by tentacles at the top of the cylinder, and but one main cavity (the coelenteron) inside. Food enters, and waste products pass out, through the mouth. They have stinging cells on their tentacles, with which they can paralyze their prey.

Usually the sexes are separate. The fertilized egg generally develops into a free swimming larva or planula which eventually settles down on the sea floor, and grows into a polyp. A few corals are solitary, and the polyp, after secreting its skeleton, is subject to no further change, but in the majority of species the single individual, which originally settles on a spot, gives rise to an entire colony by vegetative growth. Sometimes the polyp sends out processes from which new individuals spring. These, in their turn, send out more processes which make further additions to the colony. In other cases the individual itself divides repeatedly and finally becomes highly compound.



CORAL-ROOT



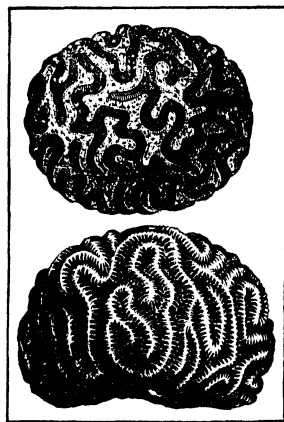
MADREPORITE CORAL

The colonies formed by different species of corals are exceedingly diverse in form. Often they are branched like trees or bushes; again, they grow in a compact mass, as with the brain corals and star corals. Sometimes they are fashioned as cups, sea fans, sea



RED CORAL POLYPS
Greatly enlarged

pens or organ pipes, or they may be moulded into other complex patterns which almost defy description. The cleaned skeletons, when they are sufficiently substantial, retain the shape of the colony. They are very beautiful, but not nearly as lovely as is the colony



BRAIN CORAL
Heliastrea heliopora

while it is alive, for then it is often exquisitely tinted. The skeleton is invested in a fleshy substance which connects the polyps. Frequently the flesh and polyps are differently colored. In the precious coral (*Coralium rubrum* or *nobile*), which is found in the Mediterranean, around Japan, and in the eastern Atlantic, the polyps are white, while the flesh in which they are embedded, and even the skeleton, are red. It is from this red skeleton that coral jewelry is carved. A. I. W.

CORAL SNAKE, a popular name given to members of a genus (*Elaps*) of poisonous snakes, found in the warmer parts of America and also in Africa. All are marked with black, yellow and coral-red rings. Two species live in the United States, the harlequin snake (*Elaps fulvius*) and the Sonoran coral snake (*E. euryxanthus*). Though these snakes are poisonous, their venom is not thought to be very strong, and, as they are of retiring habit, they are not a serious menace to man.

CORAL-TREE, the name given to a genus (*Erythrina*) of handsome usually woody plants of the pea family, with brightly colored, pealike flowers. There are about 50 species widely diffused in warm climates, many of which are grown for ornament. The cockspur coral-tree (*E. Crista-galli*), a spiny shrub or small tree native to Brazil, is often cultivated in the southern United States for its showy clusters of brilliant crimson flowers.

CORAOPOLIS, a borough in Allegheny Co., southwestern Pennsylvania, situated on the western bank of the Ohio River, 10 mi. northwest of Pittsburgh. Coraopolis is on the Pittsburgh and Lake Erie Railroad. The borough is an industrial community in an oil and gas producing region, and manufactures steel, iron, glass, springs, nuts, bolts and chemicals. The retail trade in 1929 amounted to \$4,604,291. Farming is the leading interest of the countryside. Coraopolis was incorporated in 1886. Pop. 1920, 6,162; 1930, 10,724.

CORBEL, a stone, or other piece of structural material, or a continuous row of them, arranged to support overhanging weights or structures. Corbels, or corbel courses, project beyond the face of the wall below, and are long enough so that the leverage of the weight upon the portions embedded in the wall prevents them from overturning. Thus a corbeled arch, or corbeled vault, is one in which each course of brick or stone, though laid with horizontal beds, projects inward slightly beyond the course below, until the covering finally meets at the top. Corbeled arches are common in the architecture of Sumeria and the Aegean civilization as for example the Tholos or Treasury of Atreus and the Lion's Gate, both at Mycenae, and about 1500-1200 B.C. In Romanesque architecture many cornices consist of a row of corbels decorated with ornaments or grotesques, and carrying a projecting crowning member; such a cornice is known as a corbel table. Corbels under the projecting oriel windows common in the late Gothic and early Renaissance architecture of England are often richly molded on the edges, and sometimes decorated with tracery and carving.

CORBIN, a city in Whitley and Knox counties, southeastern Kentucky, 105 mi. southeast of Louisville. It is served by bus lines and the Louisville and Nashville Railroad. Coal and clay are found in this region. Tomatoes, corn and beans are the leading crops. The city has railroad shops and a round



CORBEL, FROM A
BELFRY IN AVIGNON

house. Corbin was founded in 1884 and incorporated in 1890. The city lies a few mi. west of the beautiful Cumberland Mountains and in the near vicinity of Cumberland Falls State Park. Population, 1920, 3,406; 1930, 8,036.

CORCORAN GALLERY OF ART, a museum of art at Washington, D.C., given to the city by William Wilson Corcoran, American philanthropist. The gallery, begun in 1859, was occupied during the Civil War by the United States Government for war purposes. It was not completed until 1872. The nucleus of the gallery collection was Corcoran's own considerable private collection of works of art. This he presented to the city together with a large endowment. The present Corcoran Gallery, designed by Ernest Flagg, of white marble in the Neo-Grecian style of architecture, was erected from 1894-97.

In the gallery collection are some of the finest paintings and sculptures in America. Among the former are many excellent specimens of early American painters. These include a portrait of Washington, by Gilbert Stuart; *The Wood Gatherers*, by Corot; *Niagara*, by Frederick E. Church, and *The Road to Corcorneau*, by William L. Picknell. The sculptures include an admirable collection of Barye bronzes; the *Greek Slave*, by Hiram Powers; Vela's masterpiece, *The Last Day of Napoleon*, and H. A. MacNeil's *The Sun Vow*. Exhibitions of contemporary American painters are held biennially, and a free school of art is maintained in connection with the gallery.

CORD, a measure of volume used for firewood and similar materials. It comprises a pile containing 128 cu. ft., usually 8 ft. long, 4 ft. wide and 4 ft. high. In England, there have been some local variations in the cord, ranging between 128 and 162½ cu. ft.

CORDAGE MANUFACTURE. The term cordage signifies cords, lines and twines which are less than one inch in circumference. These are produced mainly from cotton, jute, hemp or flax yarns and occasionally from chemically treated kraft paper when strength is not required. A single yarn is a narrow ribbon of parallel fibers which have been so twisted as to form a spiral, and strands are made by doubling such yarns together in order to yield uniformity and strength. When a cord is made up of three strands, each containing two or more yarns, and when the strands have been twisted before being brought together or laid, the cord so prepared is said to have been cabled.

The twist must always be inserted in the opposite direction to that in which the yarns were spun. When strands are being converted into a cord upon the tube twister, cabler or laying machine they must again be twisted together in the opposite direction to that in which the strands were formed, or in the same direction as that in which the yarns were spun. This is the fundamental principle of cordage manufacture. When an exceptionally hard make of twine is required, and one which will not untwist when cut, the yarns must be given some extra twist called *forehard* at the moment when they are twisted together.

Plaited cords are made on special machines by crossing and re-crossing several strands of yarn together.

C. R. C.

BIBLIOGRAPHY.—H. R. Carter, *Rope, Twine and Thread-making*, T. Woodhouse and P. Kilgour, *Cordage and Cordage Hemp and Fibres*.

CORDAITES, lofty and slender extinct trees which formed a conspicuous element in forests of Carboniferous and Permian times. Their strong upstanding shafts, unbranched till near the summit, were sometimes 120 ft. tall and crowned by huge simple, parallel-veined leaves arranged spirally. In some species these were swordlike and a yard long, in others blunt, and over a foot broad. Important coalbeds are composed almost entirely of the leaves of these dominant evergreens. The fructification was in the form of small male and female catkins. The seeds resembled those of living cycads. The pithed wood is compared to that of ancient conifers, *Araucarias*. Scott describes the Cordaites as an advanced group intermediate between true conifers and maidenhair trees, having some points in common with the cycads.

CORDAY D'ARMONT, MARIE ANNE CHARLOTTE (1768-93), assassin of Marat, was born at St. Saturnin in Normandy of a noble but poor family. She sympathized with the revolution until the Reign of Terror, when influenced by Barbaroux, she saw in MARAT and ROBESPIERRE the enemies of France. On July 1, 1793, she undertook the journey to Paris. After being twice refused admittance to see Marat, she succeeded on July 13, and assassinated him. Soon after committing the murder she was captured, brought to trial before the Revolutionary Tribunal, and sentenced to death. She died on July 17, 1793.

CORDELE, a city in southwestern Georgia, the county seat of Crisp Co., 153 mi. south of Atlanta. Four railroads afford transportation. The chief crops of the vicinity are cotton and peanuts. Cottonseed oil, fertilizers and peanut candies are manufactured. Crisp County is noted for its publicly-owned hydroelectric system. Cordele was founded in 1887 and incorporated in 1888. It has a commission-manager form of government. Pop. 1920, 6,538; 1930, 6,880.

CORDELIERS, a powerful association of French revolutionists, which took its name from the old convent of the Cordeliers, Franciscan Friars Minor, in Paris where its first meetings were held. Its actual title was The Society of the Friends of the Rights of Man and of the Citizen, and one of its chief objects was to denounce all infractions of the Rights of Man. Marat and Danton, and also Hebert, were leaders in the organization. It was the club of the Cordeliers which first demanded a republic and raised the cry of "Liberty, Equality, and Fraternity." To its quarrels with the Jacobins, its rival as a radical organization, many events of the Reign of Terror are traced. It was dissolved, along with all other political clubs, in Aug. 1795.

CORDIALS, liqueurs in which alcohol and sugar have been added to fresh fruit juices or to aromatic herbs and the infusion distilled. For example, ab-

sinthe is made by distilling an infusion of wormwood. Other flavorings used in preparing cordials include orange and lemon peel, peppermint, thyme, citron, aniseed, and fennel.

CORDILLERA, the assemblage of mountain systems covering the western part of North America from Alaska to Panama. The major divisions are the Rockies which constitute the main axis and are the most unified mass; the Coast ranges; the Cascade-Sierra Nevada system crossing Washington, Oregon and California; and the basin and range province consisting of the Great Basin of Nevada and western Utah, the Sonoran desert of southern California and Arizona, and the Mexican highlands in southern New Mexico and Old Mexico. In the latter country the mountains are known as the Sierra Madre Oriental and Sierra Madre Occidental, between which is the Mesa Central. They continue as a single chain through Central America. In the United States there is a clear cut separation of component ranges by broad intermontane plains or plateaus but the arrangement farther north becomes complex. Near the latitude of Spokane the Cordillera narrows and the whole series of ranges is condensed into a phalanx of closely set mountains which maintain a substantial unity into Alaska. At the 49th parallel the units from west to east are the Coast range, Cascades, Columbia system, Selkirk, Purcell range and Rockies.

In Canada, between the Rockies and the Coast ranges, the section called Interior Plateaus contains the Caribou, Cassiar and Pelly mountains. In Alaska the Coast ranges consist of the Fairweather, St. Elias and Wrangell mountains, and the Alaska range lies inland while the extension of the Rockies or Endicott range parallels the Arctic coast. The volcanic Aleutian range extends southwest from Cook Inlet to the end of the Alaska peninsula.

The highest peaks are found near either end of the Cordillera. Mt. McKinley, 20,300 ft. in the Alaska range has the maximum elevation of the continent, and Mt. St. Elias, 18,008 ft. and Mt. Logan 19,850 ft. are located near the Canada-Alaska line. Orizaba, 18,564 ft. and Popocatepetl, 17,543 ft. are in Mexico. The highest peak in the United States is Mt. Whitney, 14,496 ft.

CORDITE, a smokeless gunpowder prepared in cord form. The original cordite consisted of nitroglycerine, nitrocellulose and vaseline. It caused gun erosion and was replaced by Cordite M.D., in which less nitroglycerine and more nitrocellulose are used. See *also* EXPLOSIVES.

CÓRDOBA, a city of Argentina, capital of Córdoba province, situated in the elevated valley of the Río Primero, 246 mi. northwest of ROSARIO. The city still retains much of its old-world appearance, with bastioned walls, fine cathedral and university buildings, old monastic establishments and ancient family mansions. It is, however, a progressive town, with many fine, well-planned streets, public offices, commercial establishments and beautiful gardens. It is lighted by electricity and is served by electric tram-

ways. There are some manufacturing establishments, but the city is chiefly interested in the cereal and cattle trade. In a suburb is situated the Dique San Roque reservoir, one of the largest semi-natural reservoirs in the world. A wall of masonry was built across a gorge among the mountains, forming a lake which holds 825,000,000 cu. ft. of water. Here the only great irrigation project in the republic transforms desert wastes into pleasant orchards and meadows of vegetables and alfalfa.

The town was founded by Cabrera in 1573 and was famous as a center of the Jesuit missions. It afterwards fell into decay, but the opening of the railway in 1870 has greatly restored its prosperity. Est. pop. 1930, 220,000.

CÓRDOBA or **CORDOVA**, a city of Spain, capital of the province of the same name, situated on the Guadalquivir River. The famous old city still exhibits its Moorish character with its maze of narrow streets, but in the outskirts modern thoroughfares have been laid out. The houses are Moorish in style, unpretentious outside, but often with splendid inner courts. Parts of the old wall, gates and towers, the Guadalquivir bridge, and above all the huge cathedral, *La Mezquita*, once the chief mosque of the Western Caliphate, 785-990, are the chief monuments of Córdoba's brilliant past. It is the seat of a bishop and of a provincial governor, has schools, seminaries and large libraries, and is a center of agricultural activity. Industries include metal working and the manufacture of textiles. The once flourishing manufacture of Cordovan leather has now almost disappeared. Est. pop. 1929, 83,376.

CÓRDOBA CATHEDRAL, a splendid example of Moorish architecture in Córdoba, Spain, completed under the caliph Hisham II (976-1009). It is surrounded by a strong wall and was originally both a mosque and a fortress. The ground plan is a rectangle, about one-third of which is taken up by the celebrated Court of Oranges and the cloisters on the north, west and east. The interior of the cathedral is a labyrinth of 850 pillars dividing the church into 19 aisles north and south and 29 aisles east to west. These pillars are of jasper, porphyry and many-colored marbles. The building has suffered from endeavors to convert it into a Christian cathedral.

CORDOVA, a seaport town on the southern coast of Alaska, in the third judicial division, situated on Orca Inlet, in Prince William Sound, 1,600 miles northwest of Seattle. It has steamship and railroad connections. In the surrounding region are vast tracts of timber, gold and copper mines, and the only producing oil-fields in Alaska. Cordova has fish canneries and lumber mills. It is an important shipping point, the terminus of the Copper River and Northwestern railroad, which connects the coast with the Kennecott copper mines. The town was founded in 1907 and incorporated in 1909. Two large inland glaciers, the Childs and the Miles are accessible from this point. Bear and mountain goat abound in the region. Pop. 1920, 955; 1930, 980.

CORDULA, a genus of lady's-slipper orchids, commonly known in greenhouse cultivation as cypripediums. There are about 50 species, natives of the tropics of eastern Asia and New Guinea, several of which, together with numerous hybrids and variants, are popular glasshouse ornamentals. They differ from the wild North American lady's-slippers (*Cypripedium*) chiefly in the venation of the leaves and in minor characters of floral structure. See also *CYPRIPEDIUM*.

CORELLI, MARIE (1864-1924), English novelist, was born May 1, 1864, of Italian and Scottish parentage. She was adopted when an infant by Charles Mackay, the song writer, and was educated in a French convent. Her first novel, *Romance of Two Worlds*, was immediately successful and established her as a writer of fantastic romance. She was a gifted narrator and had a fertile imagination. Among her best known stories are *The Soul of Lilith*, *The Sorrows of Satan* and *The Master Christian*. She died at Stratford-on-Avon, Apr. 24, 1924.

COREOPSIS, an attractive genus of plants of the composite family, called also tickweed, comprising about 70 species, about 30 of which occur in the United States. They are mostly annual or perennial herbs, usually with opposite leaves and showy flower-heads, composed of yellow, parti-colored, or rarely purple rays surrounding a yellow disk. As they are of easy cultivation, many are grown as ornamentals.

COREY, WILLIAM ELLIS (1866-), American steel magnate, was born in Braddock, Pa., May 4, 1866. He studied at Duff's College, Pittsburgh, and at 16 years of age had his first position in a chemical laboratory. In the Homestead Steel Works, where he was later employed, he held various executive positions until he became general superintendent in 1897, succeeding Charles M. Schwab. Corey was one of the men associated with Andrew Carnegie in developing the steel industry, and in 1901-03 served as president of the Carnegie Steel Company. He was president of the U.S. Steel Corporation from 1903 to 1911.

CORFU, largest and one of the most beautiful of the Greek islands of the Ionian Sea, separated from the coast of Epirus by a narrow channel. The length of the island is about 40 mi. and its greatest breadth about 20.

Corfu, the capital of the island, and its only city, is situated on a beautiful eminence. One of its most impressive buildings is the Achilleion Palace, used as a winter residence by William II of Germany. There are more than 35 Greek churches and the city is the see of Greek and Roman Catholic archbishops. Pop. 1928, 32,221.

Founded by Corinthian colonists about 734 B.C., in the Hellenistic period Corfu was besieged by Cassander. Later the Romans made it into a free state, but it was subsequently ruled by Sicilians, Genoese, and Epirotes. In 1401 it fell under Venice. Later it was under French administration, but in 1815 the city became the residence of a British commissioner. In 1864 city and island were ceded by Britain to

the kingdom of Greece. During the World War the Serbians, retreating through Albania, landed in Corfu and made it their temporary capital. The Serbian parliament met in the city theater on Sept. 10, 1916. Pop. 1928, 106,251.

CORFU INCIDENT, THE, a critical episode in the history of international relations since the World War. On Aug. 27, 1923 the Italian members of the international commission for delimiting the Albanian frontier, Gen. Tellini and four others, were fired upon by an armed band and all killed. The attack took place within the borders of Greece; but there was no proof that the assassins were Greek. Mussolini held the Greek Government responsible, however, and demanded apologies and reparation. When the latter refused to accept certain of these conditions, an Italian fleet arrived at Corfu, bombarded the town, killing 20 persons and wounding about 30, and occupied the island, Aug. 21. In the dangerous crisis that developed, it became an important question whether the dispute should be settled by the League of Nations or in the Conference of Ambassadors. Greece appealed to the former but agreed to accept a decision by the latter. The Conference, with the cooperation of the League, soon brought about a settlement whereby Italy was awarded the reparation she had insisted upon, 50,000,000 lire. Upon the acceptance of these terms by the Greeks, Corfu was evacuated by the Italians on Sept. 27.

CORIANDER (*Coriandrum sativum*), a strong-smelling annual of the parsley family native to southern Europe and widely naturalized in the United States. It is a smooth, slender, branching herb, 1 to 3 ft. high, bearing finely divided leaves and small white flowers. The aromatic, roundish, seedlike fruits, for which the plant is cultivated, are used as seasoning and flavoring, especially in making confections and pastries.

CORINNA (c. 500 B.C.), Greek poetess, was born at Tanagra in Boeotia. She was nicknamed "The Fly." She was said to have been a pupil of Myrtis and the teacher of PINDAR. Her poetry was lyric, written in Boeotian dialect. She entered the contests in Greek poetry and was favorably criticized in her day. Only fragments of Corinna's work remain.

CORINTH, one of the oldest cities of Greece, situated between the Gulf of Corinth and the Saronic Gulf on a rocky isthmus connecting the Peloponnesus with the mainland of Greece. Aeolian Sisyphus was supposed to have founded the city about 1350 B.C. The Acrocorinthus was the citadel built on the side of a mountain and commanding all roads to the Peloponnese. The isthmus had three harbors, Lechaëum on the Gulf of Corinth and Schoenion and Cenchræe on the Saronic Gulf. Corinth became a city of great wealth and power and sent out several colonies, the most important of which were Syracuse and Corcyra. Except during the period 657-582 B.C. when governed by tyrants, it was ruled by an oligarchy. The Romans sacked it in 146 B.C., but Julius Caesar rebuilt it in 46 B.C.

CORINTH, a city in northeastern Mississippi, the county seat of Alcorn Co., situated 90 mi. southeast of Memphis; served by three railroads. The region has large quantities of timber; dairying, truck farming and poultry raising are important interests. The chief local manufactures are lumber, machinery, milk products, hose and clothing. Corinth was in a strategic position during the western campaign of the Civil War. Twenty miles northeast in Tennessee the BATTLE OF SHILOH was fought successfully by the Federal forces on April 6-7, 1862; in October 3-4 the Union was again victorious at the BATTLE OF CORINTH. There is a national cemetery with 5,754 graves; and a national military park marks the Shiloh battlefield. Pop. 1920, 5,498; 1930, 6,220.

CORINTH, BATTLE OF, Oct. 3-4, 1862, an engagement of the CIVIL WAR in which the Confederate army attempted to dislodge the Union army under Generals Grant and Rosecrans from its headquarters at Corinth, Miss. The Confederates, led by Generals Van Dorn and Price, launched a desperate charge sustained by bitter fighting for two days. Rosecrans held his own, and Van Dorn on the 5th retreated. But Rosecrans, contrary to Grant's orders, failed to follow up the victory by immediate pursuit. The Confederate loss was 5,000; the Federal loss, 2,500. The Confederate army in the West did not recover from this repulse.

CORINTH CANAL, in Greece, traversing the Isthmus of Corinth, linking the Corinth and Saronic Gulfs, thus shortening the distance between certain Mediterranean ports and the Black Sea. The approximate dimensions of the canal are: length, 4 mi.; width, 72 ft.; depth, 26 ft. This waterway has no locks and the approaches at the extremities are protected by jetties constructed out into the sea. Nero wanted a canal to cross the Isthmus, but had to abandon the undertaking since it proved too large a project. Work on the present canal was begun in 1882 and completed 11 years later at a cost of \$6,400,000. Situated at its terminations are two towns, Isthmia at the southeastern and Poseidonia at the northwestern. Large vessels prefer the more circuitous journey around Cape Malea, since navigation is difficult in the Corinth and Saronic Gulfs.

CORINTHIAN ORDER, in classic architecture, the fourth of the five orders, or codified arrangements of columns and entablature. See ORDER.

CORINTHIANS, EPISTLES TO THE, in the New Testament, are two letters written by the Apostle Paul to "the church of God at Corinth," probably in the spring and late summer of 56 or 57 A.D., and evidently written from Ephesus and some place in Macedonia. The church at Corinth had been founded by Paul after his visit to Athens, as described in Acts 18, when he remained there for 18 months. There were other letters to Corinth which are lost, according to internal evidence from the two which have been preserved. In Corinth, the capital of Roman Greece, there were certain excesses in the church: selfish and luxurious display, partisanship, boasting,

unseemly behavior by the women members, even pagan customs which had not been given up, and the first letter deals with these matters. This epistle contains the famous chapter on love, beginning, "If I speak with the tongues of men and angels, but have not love, etc." The second letter is kinder, expressing thanks for better reports of the church life, and closes with Paul's well-known vindication of his apostleship, "Are they ministers of Christ? I am more; in labors more abundant, in stripes above measure, in prisons more frequent, in deaths oft."

CORK, a county borough and seaport of County Cork, Irish Free State, situated on the Lee, an inlet of Cork Harbor, about 165 mi. southwest of Dublin. Anciently *Corcachmor Mumham*, or Great Marsh of Munster, it occupied an island formed by two channels of the river, and such names as Morrison's Island still persist in the old city. Springing up about a 7th century ecclesiastical foundation of St. Finbar, Cork was frequently harried by Norsemen until about 1012 when the Danes founded a trading post that thrived until the Anglo-Norman conquest. The modern city has extended across the North and South channels, but the public buildings remain largely on the original island. A race course and park lie upon the outskirts, in which there are also many handsome country-houses. Of particular interest are the Protestant and Catholic cathedrals, both of the last century; University College, and 6 mi. away Blarney Castle with its celebrated stone. As the third largest city in Ireland with English and continental trade, Cork enjoys a commercial advantage in its great, natural harbor. Butter has been a chief export since the 17th century. Among local manufactures are woolen goods, distilling, tanning and founding. Pop. 1926, 78,490.

CORK is the outer bark of the oak *Quercus Suber*. It is taken from the tree during the months of July and August, the surface cleaned and the strips flattened by heat and pressure. This also closes the pores and gives a better surface to the material. Seventy per cent of commercial cork comes from Spain and Portugal. The average yield of a tree is 45 lbs., but may be as much as 500.

Because of its elasticity and imperviousness to air and many liquids, cork is especially suitable for stoppering bottles, for which it has long been used. Even the crown caps so widely used on soft drink bottles have as inner lining a thin sheet of cork.

Huge quantities of cork are used in America for linoleums and other patent floor coverings. Linoleum is a mixture of ground cork and linseed oil put through one or more of several secret processes. Thick sheets of virgin cork, or sheets made of ground cork held together with a binder, are used for water, weather and sound-proofing. Because of its lightness and strength, cork is used in life preservers and other life-saving apparatus. High-grade artificial limbs are made from cork, which is also widely used as a waterproof inner shoe lining. See CORK TREE.

CORK TREE (*Quercus Suber*), a medium-sized, evergreen species of OAK yielding the CORK of com-

merce. The tree, which is a native of southern Europe and northern Africa, is extensively cultivated in Spain and Portugal. It grows 30 to 50 ft. high with a broad, round-topped head and very thick, deeply furrowed, spongy, elastic bark, which is naturally shed in layers at intervals of eight or nine years. For commercial purposes the first removal of cork from young trees takes place when they have attained an age of about 20 years. This virgin cork, which is of inferior quality, is used chiefly in tanning and for rustic work. Thereafter the bark is harvested every eight or ten years. With each successive removal the quality improves and the process is continued in the case of average trees for a period of 150 years or longer. When properly removed the stripping of the corky layer is said to be beneficial to the tree. The cultivation of the cork tree has recently become established in eastern India. The tree is also experimentally grown in southern California.

CORKWOOD, a name given to various trees with exceedingly light wood. In the United States *Leitneria floridana*, a small tree native to southern swamps, with one of the lightest woods known, is called corkwood. The **BALSA** (*Ochroma Lagopus*), the **ALLIGATOR APPLE** (*Annona palustris*) and the majagua (*Hibiscus tiliaceus*), of tropical regions, are also known as corkwood.

CORLISS, GEORGE HENRY (1817-88), American inventor, was born in Easton, N.Y., June 2, 1817. He conceived an idea for a sewing machine which in 1844 he tried to market in Providence, R.I., and while there became associated with a firm manufacturing steam engines. In 1848 the manufacture of a stationary steam engine improved by his inventions, particularly that for securing uniformity of motion, was undertaken by the Corliss Steam Engine Co. His mechanical genius is often compared to that of James Watt. Corliss died in Providence, Feb. 21, 1888.



G. M. SUTTON. "BIRDS OF PA."
J. HORACE McFARLAND CO. COPYRIGHT
DOUBLE-CRESTED CORMORANT
Phalacrocorax auritus

CORMORANT, the common name for a family (*Phalacrocoracidae*) of large, web-footed, chiefly maritime birds allied to the pelicans and anhingas. There are upwards of 40 species, found usually on rocky coasts and ranging from Greenland and Siberia southward to New Zealand, but most numerous in the tropics. They have powerful bodies, 2 to 3 ft. in length; short, strong legs; sharp-edged, strongly hooked bills, dilatable throats, and dark, glossy, compact plumage. Cormorants are sociable in habit, often coming together in vast flocks, and generally breed in communities, building rude nests on cliffs or in low trees and laying 3 to 5 rough greenish eggs. They feed voraciously upon fish, which they catch with

great skill, and, because of their greatly distensible throats, often swallow prey of large size.

The common cormorant or shag (*Phalacrocorax carbo*), a highly intelligent and easily tamed bird, is found in various races widely throughout the world. Since early times it has been trained to catch fish, a ring being placed around its neck to prevent it from swallowing its prey. Though usually practiced as a sport in Europe, fishing with cormorants is an important industry in China and Japan.

CORN, called also Indian corn or maize, an annual herb (*Zea mays*) of the grass family, is America's greatest contribution to the food resources of the world. It not only furnishes a cereal grain highly esteemed for human and animal nutrition but its herbage, in its green state or preserved as silage or as dry fodder, is particularly valuable as cattle roughage. For stock feeding the grain is fed on the cob, shelled or as meal, dry or moistened with water, milk or buttermilk. Immense quantities are used for making starch, corn syrup, glucose, breakfast foods and other commodities. The stalks are employed in making insulating, building and packing materials and the cobs for fuel.

The name corn is the old Anglo-Saxon word for seed or grain especially of the cereals that are still in use for human and animal food in Great Britain. In America the name corn is restricted to maize derived from *mahiz* or *marisi*, Haytian names for the plant and its seed. In Europe for many years it was called Turkey corn or Turkey wheat because, like the turkey fowl, it was supposed to have come from Turkey.

History. If evidence were lacking as to its nativity the fact that corn was not cultivated in any other part of the world until after Columbus returned from America is sufficient proof; for had it existed anywhere in the Old World its merits would have attracted attention and made it a rival of wheat, barley, rye and rice. In all parts of the New World colonists and explorers reported maize to be the staple food of the Indians. In 1498 Columbus reported to Ferdinand and Isabella that his brother "found a dense population entirely agricultural, and at one place passed through eighteen miles of corn fields." About 500 years earlier (1002) Thorwald reported having seen a "wooden crib for corn" when he wintered at "Vinland." Such records are extended beyond the dawn of American history by archaeology, ethnology and philology, all of which indicate that corn is a native American cereal.

Main Types. Though corn is said to be a monotypic genus, it varies so widely that its varieties have been grouped by Dr. E. L. Sturtevant in seven "agricultural species" as follows: Pod corns, whose ears resemble those of other varieties but whose grains are also inclosed in individual husks; pop corns, dwarf varieties with small ears and little, very hard kernels which turn inside out when popped by heat; flint corns, with exceptionally hard seeds; dent corns, each kernel conspicuously dented at its large end; sweet corns, the seeds of which are translucent, and more or

less shriveled and sugary; soft corns, lacking the horny characters of dent, flint and pop varieties; starchy-sweet corns, with seeds resembling those of sweet corn and in addition are starchy at their smaller ends.

Economic Importance. Corn in its various groups is the most valuable American crop. Its value for many years has exceeded a billion dollars annually. In the days before the automobile became popular, hay, which really includes several distinct species of plants was its nearest competitor but even then hay was only about half as valuable as corn grain, to say nothing of the value of the corn herbage fed green, as silage or dry stover. Its third competitor is cotton; its fourth wheat. America has long produced two or three times as much corn grain as the rest of the world. Europe ranks next, South America third and Africa fourth. The United States leads the individual countries with Argentina, Rumania, Yugoslavia, Italy and Hungary following usually in the order named.

According to the U.S. Department of Agriculture *Yearbook* the corn crop of 1900 was 2,500,000,000 bu.; of 1910, 2,886,000,000 bu.; of 1920, 3,209,000,000 bu.; and of 1930, 2,081,000,000 bu. The same authority gives the average production for 1924-30 for the United States and for the leading states as follows:

CORN PRODUCTION, U.S.,

7-Year Average, 1924-30

Division	Acreage (1,000 Ac.)	Production (1,000 Bu)	% of Tot. Prod.
UNITED STATES	99,933	2,599,175	100.0
LEADING STATES:			
Iowa	11,058	410,902	15.8
Illinois	9,119	311,893	12.0
Nebraska	8,981	220,763	8.5
Missouri	6,125	153,580	5.9
Indiana	4,401	146,731	5.6
Minnesota	4,281	138,790	5.3
Ohio	3,541	125,671	4.8

Though these figures are impressive they do not represent the value of the crop because only a relatively small part is used directly for human consumption. Only 4 or 5% is exported as grain or meal; perhaps twice as much is used in America as meal, "break-fast food," glucose, syrup and other manufactured products, but the great bulk of the crop never leaves the farms in the form of grain. It is fed mainly to cattle for making beef and milk and to hogs for pork, bacon and ham. In addition to the profit derived from the sale of corn as meat, milk and milk products is the value of the manure retained on the farms and utilized to maintain soil fertility. This practice, so generally popular, is the salvation of American agriculture. See WHEAT; BARLEY; RYE; OATS.

Food Value. The composition of the grain, and consequently the food value, varies in different varieties and may be altered by breeding and selection. A typical variety contains, in percentages: moisture 10.7; protein 10.0; fat 4.3; carbohydrate (mostly starch) 71.8; fiber 1.7; ash 1.5; phosphorus 0.7. As a food or feed, corn needs to be supplemented by mineral salts, by proteins containing certain amino acids that corn

proteins lack, and by foods containing the vitamins absent from corn as from most ungerminated seeds. The yellow varieties contain a certain amount of fat-soluble vitamin B, which is lacking in the white varieties.

Cultivation. Few other plants compare with corn in adaptability to climatic conditions. From a plant which in its Mexican home requires six months to attain its 20 ft. height and mature its ears, it has been modified so greatly that the dwarf 3 to 4 ft. varieties, developed to meet conditions in the Canadian Northwest and adjacent states, require only 70 to 80 days to mature their ears. The importance of this is conspicuous not only because of the plant itself but because it permits the introduction of a cultivated crop in the rotation with the small grains which should never be grown continuously on given areas. Other varieties are also being worked in rotations in other sections where corn was formerly considered unprofitable or impractical and where summer fallowing was the rule.

Since the late 19th century, through the initiative of P. G. Holden and his associates, the selection of seed corn has undergone a revolution that now annually means immeasurable millions of bushels of increased production over that of former years. The method starts in the field where the ears of plants that bear the largest number of ears are gathered separately and judged according to definite standards of weight, form, size and color. The following year the seed from each ear is sown in a numbered row by itself. During the growing season careful notes are taken of the plants in each row. In the fall ears of the most prolific and sturdy plants in the rows that give the best account of themselves are selected as seed parents for the following year.

Equally important is the care of the ears to be used for seed. As they contain considerable moisture they are thoroughly dried to prevent molding; stored during winter in dry, frost proof quarters to prevent killing of the little dormant plant in each seed; and tested for viability prior to the time of sowing. This testing consists in sprouting 10 seeds taken from various parts of each ear, noting the strength of germination and planting the seed from only those rows of plants whose ears show a high percentage of strong sprouts. Seed from the remaining ears is used to sow the general field. In countless instances this method continued during a series of years has increased production from 10 to 25% above that of previous seasons.

Though corn will grow in almost any well-drained soil it produces best in land too rich for other cereals. Hence abundance of humus and plant food are essential to high productivity. The humus is maintained by manuring and plowing under crops of clover, cow-peas, vetches and other legumes which also add quantities of nitrogenous plant food secured from the air. Plant food is also contained in manure and chemical fertilizers. The former is best applied to the corn because of its richness; the latter to the small grains

which must not be overfed with nitrogen for fear of lodging.

In addition to plows and harrows for fitting the land for seeding corn is planted, cultivated and harvested by a greater variety of special machines than any other crop. They not only save time and labor but have made possible the growing of vast areas, especially in the middle western states. M. G. K.

CORN BELT, the name given to that portion of east central United States which is largely devoted to the growing of corn. The region includes western Ohio, Indiana, Illinois, Iowa, Missouri, eastern Nebraska, eastern Kansas, southern Minnesota, southeastern South Dakota and the northern three-fourths of Missouri. Chief characteristics which make this region the most productive corn-growing area in the world are deep and fertile soil, abundant rainfall and hot summer nights. From 50 to 70% of the corn crop of the United States is grown in the Corn Belt. The two states of Illinois and Iowa alone usually supply about one-fourth of the total crop for the entire United States.

CORN BINDERS, machines for harvesting nearly mature corn. A binder follows a corn row, severs the stalks near the ground, forms them into compact bundles tied with twine. See also BINDERS.

CORN BORER, the larvæ of several species of moths of the families *Pyralidae* and *Noctuidæ*. Of special interest is the European species (*Pyrausta nubilalis*) which appeared in America probably about 1910 and has since become a serious pest from New England westward and southward. The flesh-colored caterpillar, about an inch long when mature, feeds at first on the leaves. Then it bores into the tassels, stalk, leaf-ribs and ears. In severe infestations, the corn crop is destroyed. Where infestation is slight, the plants are much weakened, tassels broken off, and ears rendered unfit for food. Early destruction of infested stalks, deep fall plowing and crop rotation are the only checks that as yet promise control. The next best hope is parasitism. Other corn borers, sometimes mistaken for the above species, are the larger and the lesser cornstalk borers and the stalk borer.

CORN COCKLE (*Agrostemma Githago*), a hairy annual of the pink family called also corn campion. It is a native of Europe and Russian Asia, where it is abundant in grain fields, and is widely naturalized as a weed in the United States and Canada. The erect, slightly branched stem, clothed with long, whitish hairs, bears narrow leaves, showy red flowers, 1 to 3 in. across, and a one-celled pod (capsule) containing numerous black, poisonous seeds.

CORNEA, DISEASES OF. See EYE, AFFECTIONS OF.

CORN EAR-WORM, the larva of a large yellowish or brownish moth (*Chloridea obsoleta*) of the family *Noctuidæ* that ravages various crops. It is also called cotton boll-worm, tomato fruit-worm, and tobacco false budworm. When full grown it is about 1½ inches long, very variable in color. In corn it

feeds in the ear, especially of sweet corn; in tomatoes it eats the pulp. In cotton bolls it works similarly, the third brood doing the most damage. On tobacco it destroys the buds and young stalks. Two broods are usual in the North; four to six in the South. Eggs for the first are laid on any available food plants. Later broods do most damage. When winter approaches the worms burrow several inches in the ground, turn upward and tunnel nearly to the surface, then descend to the bottom to pupate. In spring the moths emerge through the thin layers of earth. This suggests the best means of control. Deep fall plowing of all infested fields will break the tunnels and prevent the moths reaching the surface. Cotton may be dusted with arsenical poisons or Late corn sown between the rows will attract the moths for egg laying. This remedy may be used for cotton, tobacco and tomatoes.

CORNED BEEF is prepared by soaking beef for several days in a strong salt solution to which a little saltpeter is added. The salt diffuses through the meat and the saltpeter preserves the natural red color of the beef which would otherwise be lessened by the salt. It is frequently canned.

BIBLIOGRAPHY.—A. E. Leach, *Food Inspection and Analysis*, 1920.

CORNEILLE, PIERRE (1606-84), French dramatic poet, was born at Rouen, June 6, 1606. He was destined for the law and, after being educated by the Jesuits, practised for a short time. But he had little taste for it and soon turned to literature. A comedy, *Mélite*, was produced in 1629, followed by others, but it was not until 1637, when *Le Cid* was produced, that Corneille was recognized as a real power in drama. The success of this poetical drama was far-reaching. It was translated into all the European languages, and the expression "beautiful as *The Cid*" became proverbial in the French language. *Horace* followed in 1640, *Cinna* was produced the same year, and *Polyeucte*, Corneille's masterpiece, in 1643. In 1647 he was admitted to the French Academy. Corneille's later productions gave evidence of failing power. A curious uniformity marked his best work, and in the same play was capable of writing verses of the utmost beauty in company with others which are subject to severe criticism. He suffered considerably from the rivalry of his great contemporary, JEAN BAPTISTE RACINE. Corneille is described as having been a man of unattractive personality, but amiable; he was afflicted with a marked stammer. He died at Paris, Oct. 1, 1684.

BIBLIOGRAPHY.—J. B. Segall, *Corneille and the Spanish Drama*, 1902; L. M. Riddle, *The Genesis and Sources of Pierre Corneille's Tragedies from Médée to Parthénice*, 1926.

CORNEL, a name sometimes applied to various species of Dogwood (*Cornus*), especially to the cornelian cherry, the bunchberry and the flowering dogwood.

CORNELIUS, ST., bishop of Rome, 251-253, died a martyr's death. He was lenient to those who had lapsed from Christianity, in opposition to upholders

of the Novitian Schism, which was fairly widespread and favored a church consisting of the "pure" (*katharoi*) only. His antipope was Novitian, founder of the schism which bears his name.

CORNELIUS, PETER VON (1783-1867), German painter of religious and mythological subjects, was born in Düsseldorf, Sept. 27, 1783. After studying at the Academy in his native city he went to Rome, where he joined the group known as the Nazaries or Nazarites because of their interest in religious painting. Cornelius had an important part in the biblical frescoes executed by the group in the villa of the Prussian consul on the Pincian Hill. In 1820 Cornelius became head of the Düsseldorf Academy and having stirred national interest with his illustrations for the Nibelungen-Lied, which recalled the work of Dürer, he was commissioned by King Ludwig to design the vast frescoes for the Munich Pinakothek and for the Glyptothek. In 1825 Cornelius was appointed head of the Munich Academy, and became the founder of the Munich school of painting. His cartoon *The Four Riders of the Apocalypse*, designed for the Campo Santo of Berlin, is his masterpiece. Cornelius died in Berlin, Mar. 6, 1867.

CORNELL, EZRA (1807-74), American capitalist and philanthropist, was born at Westchester Landing, N.Y., Jan. 11, 1807. He received a common school education and at an early age earned his own living by carpentry work. In 1828 he moved to Ithaca and worked for about 12 years in a flour mill. But he was primarily interested in mechanics and was usually working on some piece of machinery. In 1843 he invented a machine for laying telegraph wires which led to his association with Samuel Morse and his supervision of the first telegraph line in America, and later the extension of telegraph service throughout the country. He made a large fortune in this development and after building the Cornell library in Ithaca founded and endowed CORNELL UNIVERSITY. He died at Ithaca, N.Y., Dec. 9, 1874.

See A. B. Cornell, *True and Firm, a Biography of Ezra Cornell*, 1884.

CORNELL COLLEGE, at Mount Vernon, Ia., a non-sectarian, coeducational institution, affiliated with the Methodist Episcopal Church. Opened in 1853 as Iowa Conference Seminary, it was incorporated as Cornell College two years later. The college had productive funds of \$1,600,000 in 1931. The library has 57,000 volumes. In 1931-32 there were 600 students, with a faculty of 48, headed by Pres. Herbert J. Burgstahler.

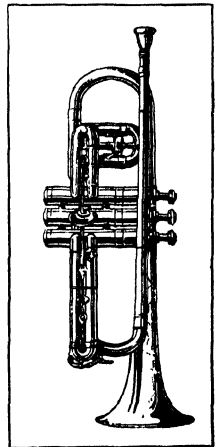
CORNELL UNIVERSITY, a coeducational, non-sectarian institution at Ithaca, N.Y., which opened in 1868. The university owes its foundation to EZRA CORNELL and a grant from the Federal Government, in accordance with the Morrill Act of 1862. Cornell agreed to give the university \$500,000 if the New York State legislature appropriated to it the entire proceeds from New York's share of the grant. In spite of strong, long drawn out opposition the legislature in 1865 passed the bill incorporating Cornell

University and appropriating to it the income of the sale of public lands granted New York State by Congress. Cornell took over in trust the state's share of educational grant when the scrip was about to be thrown on a glutted market, and converted that portion into \$4,000,000 of endowment for the university. ANDREW D. WHITE, who had been instrumental in obtaining the grant, was the first president, and to his vision and guiding hand was due in large measure the successful development of Cornell University. The university comprises the colleges of Arts and Sciences, Engineering, and Architecture; Law School; Medical College, the main division of which is in New York permanently affiliated with the New York Hospital; Graduate School; Division of Education; New York State College of Home Economics; New York State Agricultural Experiment Station at Geneva, N.Y.; New York State Veterinary College; and New York State College of Agriculture at Cornell University. The last four mentioned are maintained by New York State, which has appropriated over \$3,000,000 for buildings and equipment, but administered by the trustees of the university. In 1931 Cornell's productive funds totaled \$24,020,872. The students enrolled numbered 5,893 and the faculty of 943 was headed by Pres. LIVINGSTON FARRAND.

McGraw Hall houses the Museum of Zoology which contains a world-famed brain collection. Goldwin Smith Hall has a notable museum of statues cast in molds over the originals, many pieces of original pottery of 2000 B.C. to 200 B.C. and original Egyptian antiquities. The library, which houses the greater portion of the university's 830,000 volumes, contains the library of Jared Sparks, pioneer collector of historical documents of America; an unrivaled Dante collection, and a Petrarch collection equaled only by one in Italy.

CORNER. When an individual or a group obtains possession of the entire floating supply of either a stock or a commodity, it is said to be cornered. Three important corners have occurred in the history of the New York Stock Exchange, viz., the Northern Pacific corner in 1901, that in Stutz Motors in 1920 and that in Piggly Wiggly stores in 1923. Corners also have occurred in the grain markets. See also SPECULATION.

CORNET, a musical wind instrument belonging to the trumpet family. It is a short conical brass tube furnished with three pistons or valves and hence



COURTESY C. & G. CORNELL
CORNET

often known as a cornet à pistons. Its tone is harsher than that of the trumpet and tends toward vulgarity rather than true brilliance. For this reason it is seldom found in the orchestra. The cornet in C has a chromatic compass extending upward a little more than two octaves above f-sharp below middle C. Cornets in other keys are transposing instruments.

CORNFLOWER (*Centaurea Cyanus*), an annual herb of the composite family commonly called blue-bottle in England, Kaiserblume in Germany and bachelor's-button when cultivated for ornament in America. It is a native of southeastern Europe, widespread as a grain field weed over most parts of Europe and northern Asia and sparingly naturalized in waste places in the United States and Canada. The low, branching stem, 1 to 2 ft. high, bears narrow, entire or sometimes divided leaves and large, showy, slender-stalked heads of bright blue, purple, pink or white flowers. See also CENTAUREA.

CORNICE, in architecture, the horizontal crowning molding or group of moldings, originally developed as the decorative treatment of projecting roof eaves, but later used as a crowning feature for any architectural feature. Egyptian cornices consist of a cavette molding at the wall top, with a torus directly below. In the timbered roofs of Asia Minor and Persia, projecting beam ends gave rise to the decorative cornice treatments of small projecting blocks known as MUTULES; MODILLIONS, when comparatively large and widely separated, or DENTILS, when small and close together. As a member of a classic ORDER the cornice is the uppermost of the three members of the ENTABLATURE, architrave, frieze, and cornice. The typical classical cornice consists of three parts, a cymatium, or crown mold, at the top, usually consisting of a CYMA recta, sometimes with a small molding beneath it; the corona, a sort of projecting shelf, with its front edge crowned by the cymatium; and a BEDMOLD beneath, consisting of one or more moldings sometimes including dentils or modillions. The soffit or underside of the corona is sometimes decorated by paneling, or by mutules.

Romanesque cornices are often bracketed out on carved corbels. Gothic cornices are single, double, or triple moldings, often, especially in France, carved with crockets or foliage. The cornices of China and Japan are usually of wood, and elaborated with lavish and ingenious small brackets. Even stone and terra cotta examples of cornices frequently follow the wooden type.

CORNING, a city in Steuben Co., southwestern New York, situated on the Chemung River, 20 mi. northwest of Elmira. Bus lines and three railroads serve the city. Corning is an important shipping center for a tobacco-growing, farming and dairying region. Glass manufacture is the chief local industry and there are also foundries and railroad shops. In 1929 the manufactures amounted approximately to \$12,000,000; the retail trade reached a total of \$8,860,382. The city is surrounded by important gas fields. Corning was settled about 1789, incorpo-

rated as a village in 1837 and as a city in 1890. Pop. 1920, 15,820; 1930, 15,777.

CORNISH, a language of the Brythonic branch of the INDO-EUROPEAN linguistic family formerly spoken in the general area of Cornwall, but increasingly superseded by ENGLISH from at least the 16th century, and practically extinct by the end of the 19th. It falls into three periods: Old (12th and 13th centuries), Middle (14th and 15th), and New (from the 15th). In inflection it generally agrees with WELSH, but is remarkable as the only Brythonic dialect to retain traces of a true genitive, (e.g., *margh*, "horse," from a hypothetical **markos*, but *verh*, "of a horse," from **marki*); and, as in Scots Gaelic (see IRISH), the present of the verb is often the type "I who speak" = "I speak."

Cornish literature is almost exclusively of the Middle period, and consists notably of *The Poem of Mount Calvary*, and of three dramas (*Ordinalia*) known as *Origo Mundi*, *Passio Domini* and *Resurrectio Domini*. To the early New period belong *The Life of Saint Meriasek*, 1504, a drama on the Creation and the Flood by William Jordan, and *The Story of John of Chy-an-Hur*, about 1667. L. H. G.

BIBLIOGRAPHY.—E. Norris, *The Ancient Cornish Drama*, 2 vols., 1859; H. Jenner, *Handbook of the Cornish Language*, 1904.

CORN LAWS, a series of laws protecting English grain producers in order to stimulate agriculture. Although specific provisions differed, all included the principle of putting a BOUNTY on the export of grain when the price fell below a specified level, and of allowing importation duty free only when the price was above a certain figure. Corn laws had existed in medieval times, but came into prominence as protective measures in the late 17th century, with the Act of 1689. The law which is most associated with the term is that of 1815. This law caused tremendously high prices of grain, as England no longer grew enough grain to be self-supporting. The laboring and manufacturing classes both opposed the law. Finally the Anti-Corn-Law League, formed by Cobden and Bright in 1839, made the question a political issue with the result that the Corn Laws were repealed in 1846.

BIBLIOGRAPHY.—R. E. P. Ernlé, *English Farming Past and Present*.

CORN MEAL (maize or Indian corn meal). Old-process meal, or water-ground meal, is made by grinding CORN coarsely between buhr stones, only the larger particles being sifted out. Some prefer it because of the rich flavor of the germ, but the oil of the germ turns rancid easily. In making new-process meal, or cream meal, the grain is cracked and the loosened hull and germ are removed by winnowing and sifting. The residue is separated into fine particles or flour, large ones known as big hominy and small ones as little hominy or grits. The hominy may be sold for food, feed, or brewing, or may be ground to grits, to meal, or to the fineness of flour. New-process meal contains about 8% protein, less than

1.5% fat, about 78% carbohydrate other than fiber (mostly STARCH), and less than 1% fiber. Old-process meal contains about 1% more protein, something more than 4% fat, and about 1.5% fiber. *See also* CORN PRODUCTS; PROTEIN IN FOODS.

CORN PRODUCTS, a general term including many important products obtained from CORN as the following.

Oil. Corn germ, a by-product in meal or starch manufacture, is subjected to heat and great pressure to express the oil. The residue, oil cake, furnishes stock feed. The crude oil is used for soap, rubber substitutes, tanning, and in the paint industry. The refined oil is used for food, and is a semi-drying oil of pale straw color with a slight characteristic flavor.

Starch. Corn, hulled and degerminated by a wet process, is ground with much water and the starch obtained by settling. It is dried and comes on the market in white lumps or as a white powder. It is used as a food, to size textiles, to manufacture dextrin, gums, and adhesives, and for many other purposes.

Syrup is made by treating starch with weak, aqueous hydrochloric acid. It consists of dextrins, glucose (grape sugar), and maltose (malt sugar) in varying proportions, depending upon the severity of the acid treatment. It is thick, syrupy, colorless, and used for food as well as in the arts.

Sugar, termed starch sugar, corn sugar, or glucose, is made from STARCH by acid treatment. Chemically, it is dextrose (glucose, grape sugar). It is less sweet than common sugar (cane sugar, beet sugar, sucrose), though equally nutritious. The best grade is a white micro-crystalline powder. Other grades are creamy, crumbly, crystalline solids and contain some dextrin, malt sugar, and water. Starch sugar is used as a food, especially in brewing and baking, and in the arts.

By-Products. The most important are high-protein feeding stuffs: the oil cake, and the gluten feed, so-called, which is obtained in the manufacture of starch.

For meal and flour, *see* CORN MEAL. For pop corn, *see* CORN.

C. L. A.

CORNS, or clavi, horny conical thickenings, which extend down into the skin and are painful and are tender upon pressure. They are of two types: the hard and the soft varieties. They occur in any position on the toes, but usually on the sides and tops, because these regions are more exposed to friction. The cause of corns is usually irritation from a shoe—either a short, pointed, or high-heeled shoe, or irregularities in the lining of the shoe. The hard corns occur on the exposed surfaces of the foot, and the soft corns occur between the toes, usually between the fourth and fifth. The cause of soft corns is approximation of the toes, the production of moisture which cannot evaporate, and heat which cannot radiate.

The treatment consists in removal of the irritation, softening and trimming of the corns and protection against further pressure. Chemicals, such as found in the various "corn cures" must be used carefully.

In serious cases radium or X-ray has been used, and occasionally surgery is required. P. L.

CORN-SALAD (*Valerianella Locusta* var. *olitoria*), a small smooth annual of the valerian family, native to Europe and often cultivated for salad. It is a much branched plant, usually about a foot high, bearing oblong leaves, about 3 in. long, and minute light blue flowers in dense heads.

CORN SPURRY (*Spergula arvensis*), a low, straggling annual of the pink family, called also poverty weed. It is found in cultivated and waste places throughout Europe and temperate Asia, often abundant as a grain field weed, and is widely naturalized in the United States and Canada. The slender, much branched stem, about a foot high, bears very narrow leaves in whorls and small white flowers in terminal clusters.

CORNWALL, the capital of the united counties of Glengarry, Stormont, and Dundas, in the province of Ontario, Canada, situated on the St. Lawrence, at the foot of Long Sault Rapids, about 55 mi. southeast of Ottawa. A manufacturing city, it is served by three important railways, and is port of call for Montreal and Lake Ontario steamers. Fishing and agriculture are carried on in the district, and industries supplied by power of the Cornwall Canal include paper, cellulose, cotton, woolen, silk, grist and saw mills. Pop. 1921, 7,419; 1931, 11,126.

CORNWALLIS, CHARLES CORNWALLIS, FIRST MARQUIS (1738-1805), British general, was born in London, Dec. 31, 1738. He received his education at Eton and Cambridge, seeing military service in the Seven Years' War. He continued in the British army until his promotion to major-general in 1775, when he was ordered to America to join in the subjugation of the colonists. His detachments took part in the victory of the battle of Long Island and suffered defeat at Trenton (Dec. 26, 1776) and Princeton (Jan. 3, 1777). He tasted victory again in the battle of Brandywine Creek (Sept. 11, 1777) for which he was given command of the Delaware. In 1780 he took part in the capture of Charleston, S.C. (May 12) and defeated General Gates at Camden, S.C. (Aug., 1780). The following March he defeated General Gates at Guilford Court House, N.C., but was forced by him later into Virginia, where after a sharp campaign he was besieged in Yorktown by Washington and Rochambeau, aided by the French fleet. Cornwallis surrendered, Oct. 19, 1781. This capitulation marked the complete triumph of the American cause. Cornwallis returned to England and subsequently was military governor in Ireland and India. He died at Ghazipur, in Benares, India, Oct. 5, 1805.

CORONA, in astronomy, the very tenuous, extreme outer atmosphere of the SUN. During the period of totality in a solar eclipse the corona appears as an irregularly circular halo surrounding the sun.

CORONA, in electrical engineering, a bluish glow which forms about an electric conductor when the voltage reaches a sufficiently high value to cause a

breakdown of the air. It forms on transmission line conductors. The loss of power due to corona is reduced by using large diameter conductors.

BIBLIOGRAPHY.—F. W. Peek, *Dielectric Phenomena in High Voltage Engineering*, 1920.

CORONA, a city in Riverside Co., southern California, 52 mi. southeast of Los Angeles, served by bus lines and the Santa Fe Railroad. There is an airport near by. Corona is a shipping point for lemons and other citrus fruits, and has packing houses and factories producing lemon by-products. Clay, lime, cement and porphyry are quarried in the vicinity. Near by are mineral springs and natural gas wells. The city lies between the Cleveland and the San Bernardino national forests. One of the chief points of interest near by is Santa Ana Cañon. Corona was founded in 1886. Pop. 1920, 4,129; 1930, 7,018.

CORONA AUSTRINA (gen. *Coronae Austri-nae*), the southern crown, a small constellation wedged into a nook of Sagittarius. It is composed, as the name indicates, of a number of fourth and fifth magnitude stars which form a wreath. *See STAR: map.*

CORONA BOREALIS (gen. *Coronae Borealis*), the northern crown, a small but conspicuous constellation between Bootes and Hercules. It is composed of one star of the second magnitude, Gemma, the Pearl, and five stars of the fourth magnitude, arranged in a wreath or garland. *See STAR: map.*

CORONADO, FRANCISCO VASQUEZ DE (c. 1500-54), Spanish explorer of the region that now constitutes the southwestern part of the United States, was born at Salamanca about 1500. He came to Mexico in 1535 with the viceroy Mendoza and married Dona Beatrice, the daughter of the royal treasurer. Through this connection, he advanced rapidly and was made governor of New Galicia in 1539. Early in the following year, heading a well armed organization of 350 Spaniards and 800 Indians, Coronado started in search of Cibola and the Seven Cities, reported by friar Marcos de Niza. He traveled into southwestern Arizona and in July took possession of Cibola, a Zuni pueblo village. Disappointed in not finding gold, he sent parties as far as Tusayan and to the Grand Canyon of the Colorado. Still in search of treasure, Coronado and a party pushed eastward to Rio Grande and finally into Kansas. Returning to Tiguas without discovering gold, he proceeded to Mexico in 1542, with only a small fraction of his force remaining. He was considered a failure, and deprived of his governorship in 1544, he withdrew to his estates until his death. The valuable records containing descriptions of Coronado's journey have been translated into English.

CORONADO, a resort city in San Diego Co. in southwestern California, a peninsula situated between San Diego Bay and the Pacific Ocean, across the bay from San Diego. It is served by ferries and an electric car line. Coronado has long been a fashionable residential community. The city was founded in 1890. Pop. 1920, 3,289; 1930, 5,425.

CORONER, an official whose primary duty is to make an inquiry into the causes of a person's death where there is any reason to suspect that the death was not natural. When the inquest is made a coroner's jury is sworn in, having all the rights of a Grand Jury to find a verdict of murder, manslaughter or infanticide. The coroner sometimes has other duties, depending upon the local statutes which describe the functions of his office. The office of coroner originated in England in 1194 and has always been an important office there.

COROT, JEAN-BAPTISTE CAMILLE (1796-1875), French landscape and figure painter, was born at Paris, in July 1796. He studied under Michallon and Bertin at Paris, and in 1825 first visited Italy. The influence of Claude Lorrain and the 17th century Dutch landscape painters is felt in Corot's early, Italian canvases, which are tighter in technique than the later works by which he is best known. In these Corot was concerned with the play of light and the relation of values. Under the influence of the BARBIZON SCHOOL, he abolished hard outlines, reduced the opposition of colors and painted everything through a delicate veil of gray. With innumerable canvases of dancing nymphs in twilight groves Corot made his fame and fortune, but to-day it is realized that his finest works are the early, classic landscapes and the figure pieces, which throughout his life he produced for his own pleasure. The Metropolitan Museum, New York, through the Havemeyer Bequest, is richer in his figure pieces than the Louvre, whose 80 examples are largely landscapes. As a man Corot was generous and kindly; he befriended all struggling young artists and cared for Daumier in the days of his blindness. Corot died at Paris, Feb. 22, 1875.

COROZA NUT, the fruit of a small Central American palm containing very hard white seeds used as a substitute for ivory. *See VEGETABLE IVORY.*

CORPORAL, the lowest ranking noncommissioned military officer ranking immediately below the sergeant. In the armies of nearly all countries, the corporal is the leader of a squad in INFANTRY, ARTILLERY or CAVALRY. He is appointed by the regimental commander. The insignia of his rank is a CHEVRON of two stripes worn on one sleeve.

CORPORAL (Latin *corpore*), the smooth linen cloth which is laid on the altar and on which are placed the paten and the chalice.

CORPORAL PUNISHMENT, the punishment of offenses by inflicting bodily pain, particularly by flogging. Until about the beginning of the 19th century, most crimes were punishable by corporal punishment or fines. As early as the last part of the 17th century, the Quakers, repelled by bloodshed, attempted unsuccessfully to supplant corporal punishment with prisons. Flogging and similar punishments for penal offenses have often been characterized by excessive brutality and modern penological methods have almost entirely supplanted corporal punishment by more humane penalties. *See also PUNISHMENT; PENOLOGY; CAPITAL PUNISHMENT; PRISONS.*

COROT



"A LANE THROUGH THE TREES"

By Jean Baptiste Camille Corot (1796-1875). In the Metropolitan Museum of Art

CORPORATION, an association of persons, acting as one actual person within the scope of its CHARTER. Such an association of persons is authorized by law to act as a whole under a corporate name for certain defined purposes. The corporation is the form taken by a modern business as distinguished from partnership and sole proprietorship. The word company is used synonymously. To form a corporation three or more incorporators apply for a charter which, upon payment of the prescribed fees, is issued by the secretary of state of the state where incorporation takes place. In New York state charters are issued for three classes of corporations—municipalities, towns or counties; stock corporations, business, mercantile, public utility, industrial, railroad and financial corporations conducted for profit; and non-profit or mutual corporations such as boards of trade, mutual benefit associations and cemeteries. The corporation is owned by its stockholders with actual management vested in a board of directors elected by the stockholders and subject to the corporation's by-laws which are part of the charter. However, the corporation is distinct from its stockholders who may sue it. In England corporations exist by authority of the sovereign and in the United States sovereignty rests with the several states, although the United States may create corporations in a limited field. Such a right was exercised by the government during the World War in the creation of the War Finance Corporation and the Emergency Fleet Corporation.

Originally a state was required to pass a separate act for the authorization of each corporation, but in 1811 the State of New York enacted the first general corporation law enabling the secretary of state to issue corporation charters. There is great diversity of state laws affecting corporations. New Jersey was once the most liberal of all the states in regard to regulation of such organizations, but in 1913 it modified its statutes, while Delaware, Maryland and Maine tended toward greater latitude in charter requirements. The advantages of a corporate form of organization are perpetual life, large capitalization, limited liability, continuity of business policy, divisibility of capital and transferability of shares. These are offset to some extent by the disadvantages accruing from greater taxation, compulsory publicity, limitation of powers and limitation of credit through limited responsibility.

Corporations are a part of the so-called industrial revolution. In early days opportunity for large profits and need for great capital existed only in wholesale operations, usually in distant lands. The first important stock corporations in Europe were exploration and commercial development companies like the Dutch East India Company, the French *Compagnie des Indes Occidentales*, the British East India and similar companies. Many of these old British exploration companies still exist in the development of North America, Africa and elsewhere. But in the late 18th century the practical development of machinery and the application of steam power to indus-

trial purposes made large industrial profits possible and called for large sums. The invention of the steam engine revolutionized business methods and when steam railways and steam factories began to exist, old business practices became obsolete. The individual business structures of that day were but obstacles to industrial growth. Industrial enterprises which steam locomotives and steam factories necessitated could not be financed until the stock corporation was developed to enable the investing public to participate in such financing. The difficulty of early financing becomes evident when considering the early history of railroads. At first it was publicly declared that no partnership or company of Americans was rich enough to finance the building of a railroad. Not until the financial reserves of thousands of individuals were successfully enlisted in railroad enterprises by the creation of large stock corporations, did steam railroad transportation become possible.

CORPORATION COCK. See PIPE TAPPING MACHINES.

CORPORATION LAW. When a number of men have some common interests to promote, they tend to form an association of a more or less permanent character and to conceive of such an association as a unit endowed with a personality analogous to that of a human being. It has for a long time been the law of England that such an association be treated as a person by the law if, but only if, it has received a charter from King or Parliament making it a CORPORATION. This English doctrine has been adopted in the United States, the power to charter corporations being with us a prerogative of Congress or of the state legislatures, principally of the latter.

Corporations are divided into public or municipal corporations, and private corporations. The latter includes both non-profit corporations, such as charitable corporations, mutual benefit societies, and clubs, and business corporations. Most corporate litigation is concerned with business corporations.

A corporation possesses important advantages over an unincorporated group, particularly with respect to liability for debts, the separate legal personality of the corporation enabling it to incur obligations which are not the obligations of its members. In order that these advantages may be open to all on equal terms the laws of every state provide that any group of persons may become incorporated by complying with certain legal requirements, usually the signing and filing of a formal document, called articles of incorporation or something similar, and the payment of a tax. The articles of a business corporation must contain certain statements with respect to the nature of its business, the amount of its capital stock, and various other matters. They may also contain such other provisions relating to its internal organization as are not inconsistent with the corporation laws.

The beneficial interest in a business corporation is represented by shares of Stock, each member of the corporation subscribing to a certain number of shares in order to furnish the corporation with capital. In

large corporations the stock is generally divided into two or more classes with different dividend rights. Additional funds are often obtained through the sale of BONDS, but the holders of these bonds are not members of the corporation but creditors, and their contributions are not part of the corporation's capital.

The larger corporate enterprises are formed by persons known as promoters, who organize them in the expectation of inducing outsiders to take stock on terms which will yield the promoter a profit. Courts have attempted to protect corporations against unfair treatment by such promoters, but the latter have often found it possible, nevertheless, to obtain for themselves an amount of the corporation's stock disproportionate to the value of their promotion services. Recent legislation in many states has tried to check this practice by forbidding any sale of stock until a commission has investigated and approved the corporation's financial plan.

Until recently all stock was required to have a par value; and any original subscriber who received stock from the corporation at a price less than the full par value might find himself liable with the corporation's creditors in case of the corporation's insolvency. Modern statutes have made it possible to issue stock without par value, and the subscriber to such stock is liable only for the amount which he has agreed to pay. Business corporations are managed by a board of directors and by officers who are subject to their direction, the stockholders' powers of control being limited to the election of directors and to the right to vote with respect to amendments of the articles and certain other radical changes. Most states permit corporations having several classes of stock to confine VOTING RIGHTS to stock of one class. By issuing this stock only to persons favorable to the board of directors the advantage of continuity of management may be obtained, not without considerable risk of unfair treatment of the interests of non-voting stockholders. The courts have attempted to lessen this risk by declaring that controlling stockholders owe certain duties of good faith toward other stockholders whose money is invested with theirs in a common enterprise.

In response to the insistence by business men that a corporation cannot be effectively managed by town meeting methods, and is even less effective if no important change can be made without unanimous consent of the stockholders, the trend of modern corporation law is toward increasing the powers of directors and toward providing that, even where the stockholders must be consulted, the vote of the holders of a majority or two-thirds of the stock is sufficient. Thus the ordinary stockholder is to-day in the position of an absentee owner, who in return for furnishing the corporation with capital, obtains the right to share in such dividends as the directors may declare out of the profits, and to invoke the intervention of a court if his interests are unfairly treated by those in control.

The present tendency is toward increasingly large business enterprises, and this tendency is fostered by laws which permit one corporation to hold stock in

another and by laws which allow corporations to merge with one another subject to certain restrictions imposed by ANTI-TRUST LEGISLATION.

Non-profit corporations are created in substantially the same manner as business corporations and, like the latter, are managed by directors or trustees. They have no stock and are supported by dues or by voluntary contributions. E. M. D.

BIBLIOGRAPHY—H. W. Ballantine, *Manual of Corporation Law and Practice*, 1930, W. M. Fletcher, *Cyclopedia of the Law of Private Corporations*, 20 Vol., 1931, W. W. Cook, *Principles of Corporation Law*, 1925.

CORPORATION SCHOOLS, schools maintained by individual companies for training or giving additional education to their employees. Some of the corporations arrange for definite hours during the week to be spent in the schools, while others arrange for alternate weeks in the school and the industry. A few companies maintain evening schools or classes instead of breaking into the daily routine of work. The usual method is to pay the employees during their training. More and more the large corporations are accepting as their definite responsibility this giving their employees the specialized training which they cannot receive elsewhere. And it is generally agreed that this company training is not only making the employee more efficient but is creating a better understanding between the employee and company. Among the many corporations which have established these schools are the General Electric Co., the American Telephone and Telegraph Co., Swift & Co. and the Ford Automobile Co.

See J. Morris, *Employee Training*, 1921, R. N. Keppel, *Training Manual Workers*, 1928

CORPS, a term applied to two different types of military organizations. 1. A military body organized for a definite purpose, all of its members having, generally, similar functions and duties, such as the QUARTERMASTER CORPS and the RESERVE OFFICERS TRAINING CORPS. 2. A unit composed basically of a HEAD-QUARTERS, two or more divisions and certain auxiliary troops commanded by a lieutenant general.

CORPSE PLANT, a name sometimes given to the INDIAN PIPE, a fleshy, pure white saprophytic herb known also as ghost flower and American ice plant.

CORPUS CHRISTI, an important feast of the Catholic Church to celebrate the institution of the Blessed Sacrament. As the result of a vision of Juliana, a nun of Liège, the festival spread first throughout the Netherlands and was later given general recognition by Pope Urban IV in 1264, and by Clement V in the Council of Vienne, 1311. John XXII introduced the splendid central feature of the celebration, a solemn procession in which the Sacrament is carried. The Mass and office were composed by ST. THOMAS AQUINAS. In early times it was customary in the great processions to have groups representing symbolically the history of the world from the Creation to the Last Judgment. Frequently they rode on floats and enacted dramatic scenes with dialogue. The day of the feast is the Thursday after Trinity.

CORPUS CHRISTI, a port on Corpus Christi Bay, on the coast of Texas, and the county seat of Nueces Co. Three railroads, bus and motor freight lines and steamships serve the city. There is also an airport. Cotton, vegetables, fruit and cattle are produced in the vicinity. Besides agricultural products, the city deals also in shrimps, oysters and fish. There are extensive natural gas fields nearby. In 1929 the value of the city's manufactures was about \$3,000,000; the retail trade amounted to \$15,938,024. The site was an early Spanish settlement; the American town was incorporated as a city in 1876. An equable climate, a good beach, swimming, hunting and fishing make it a tourist resort. Gen. Zachary Taylor made his base here during the Mexican War. Pop. 1920, 10,822; 1930, 27,741.

CORPUSCULAR RADIATION. See RADIATION RAYS

CORPUSCULAR THEORY OF LIGHT. A theory, expounded by NEWTON, of the nature of LIGHT, according to which light is considered as a stream of very minute particles of matter traveling with high velocity. These particles are emitted by hot bodies and may be reflected (see REFLECTION) or refracted (see REFRACTION). According to the theory, the refraction, or bending, of light toward the normal on passing into a more dense medium, or away from the normal when going in the reverse direction, is due to greater gravitational attraction of the more dense medium for the particles. Thus, when the particles come close to the dense medium they are subjected to an acceleration in the direction of the normal. Accordingly, the velocity of the particles, and, therefore, the velocity of light, should be greater than in the rare medium. Newton explained the phenomenon of diffraction when light passes a sharp edge as due to the same gravitational force. The theory gave no satisfactory explanation of the phenomena of INTERFERENCE OF LIGHT or of polarized light and so was in conflict for a long period with the WAVE THEORY of light, which does explain these phenomena. No crucial experiment to decide between the two theories was found until measurements of the velocity of light in media such as water or glass were made by Foucault and others about 1862. Their work definitely showed that the velocity is less in dense media and thus gave the final blow to a theory which was already being given up.

During the last few years, certain phenomena in atomic physics, such as the photo-electric effect, have led to the adoption of a corpuscular theory of light, which is sometimes spoken of as a revival of Newton's corpuscular theory. However, the comparison of the new theory to Newton's theory is not justified, except in a very broad sense, for, if light is corpuscular, the corpuscles called PHOTONS are very different in character from those postulated by Newton. See also QUANTUM THEORY. P. I. W.

BIBLIOGRAPHY—J. K. Robertson, *Physical Optics*, 1929.

CORPUS DELICTI, the substantial fact that a crime has been committed. This derivative sense is

the meaning which the term has to-day. In an older sense it means the material substance upon which the crime has been committed, as, for example, in murder the body of the deceased, or in arson, the remains of the burned house. The law requires the *corpus delicti* to be established as a basis of conviction for a crime.

CORREGGIO (1494-1534), Italian painter, whose real name was Antonio Allegri; so called because of his birth at Correggio, in the territory of Modena. The theory that Correggio was self-taught is discredited by the completeness of his knowledge of optics, architecture and all forms of plastic art. He is now believed to have been a product of the School of Ferrara and to have studied with Francesco Ferrari Bianchi. Parma is the scene of Correggio's greatest work, the fresco of the *Assumption of the Virgin*, in the cupola of the Cathedral. In it the artist carried foreshortening to its limit. The effects of the mass of swirling, cloud-borne figures, as seen from below, was so unprecedented that the painting was referred to as a "hash of frogs." Correggio's oil paintings can best be studied at Parma, Paris and Dresden. *The Mystic Marriage of St. Catherine*, in the Louvre, Paris, is typical of the graceful suavity and superficiality of this leader of the Parmese school of painting. Correggio's work lacks the intellectuality of the Florentine painters and the chromatic brilliancy of the Venetians. The painter died at Correggio, Mar. 5, 1534.

CORRELATION, a term meaning the related movements in two or more variables. Characteristics, two or more, are recorded for the same persons or things, as height and weight, quantity and price. Are the variations in height and weight of a large group of school children of the same age related? Is lower stature associated with less weight and greater height with greater weight? When children are above average in height are they also above normal weight? Both direction of variation and degree of association are involved. The variables may fluctuate in sympathy but in opposite directions, as standard of living and birth rates, quantity and price. This is inverse as contrasted with direct correlation. A coefficient measures the degree of relationship on a scale from 0 to +1 for direct association, and from 0 to -1 for inverse correlation.

If for a given height there were only one weight, then the bond of relationship would be rigid and the correlation perfect. If a tall person were just as likely to be light as heavy, then the variables would be independent and the correlation 0. Weight sometimes remains relatively low, regardless of height, and sometimes varies in close sympathy with height. Many physical and social phenomena are neither absolutely independent nor absolutely dependent—they are associated in varying degrees. The scientific problem is to measure the character and degree of relationship between variables. Correlation between two variables does not prove that one is cause and the other effect.

R. E. CH.

CORRESPONDENCE, COMMITTEES OF, were, in the history of the British Colonies in North

America, groups for the exchange of information and advice so that the Colonies might act in unison against objectionable policies of the British Crown. In June, 1764, the General Court of Massachusetts appointed a committee of correspondence to cooperate with other provinces to obtain the repeal of the Sugar Act, prevent the passage of a Stamp Act, and otherwise protect their commercial interests. Similar committees were appointed in other colonies, but passed out of existence after the Stamp Act was repealed. When the Colonies' grievances again became exigent, the Boston town meeting, on Nov. 2, 1772, took the lead in appointing a committee to meet regularly, consult with similar bodies, prepare political matter for the press, circulate broadsides and, in general, by correspondence and otherwise, create and guide public sentiment. By Jan., 1773, there were 80 or more such committees in Massachusetts alone. The scheme of organization was adapted to county representation, and then to create an extra-legal body of patriots to speak for the colony as a unit. By Feb., 1774, all the colonies except Pennsylvania had adopted the device. In the early years of the Revolution the Continental Congress looked to the Committees of Correspondence to carry out local regulations.

CORRESPONDENCE SCHOOLS were first established in Berlin in 1856 and England in 1868 but have had their greatest development in the United States. The Society to Encourage Studies at Home, 1873, and the Correspondence University in Ithaca, N.Y., 1883, were the earliest groups to introduce instruction by mail in America. A Questions and Answers column on mining problems in the *Mining Herald*, Shenandoah, Pa., proved so popular that Thomas Foster, the editor, had a systematic course of instruction prepared and thus began in 1891 what has developed into one of the best and largest correspondence schools. These institutions may be classified as privately owned schools, definitely organized for profit, semi-public schools directed by a commercial or utility company to assist employees toward advancement and departments for extension work in universities. By far the larger number are the privately owned schools, though in 1930, 150 colleges and universities were offering correspondence courses in more than 200 subjects. Approximately 1,500,000 new students are enrolling each year in these bona fide correspondence schools, 95% taking vocational courses. Due to the fact that little or no supervision is provided by State or Federal law over these schools, many have been organized by men totally unfit financially or academically to carry on such instruction. To create educational standards and improve business ethics, the National Home Study Council was organized in 1926 by the bona fide correspondence schools.

See J. S. Noffsinger, *Correspondence Schools, Lyceums, Chautauques*, 1926.

CORRIENTES, a city of Argentina, situated near the junction of the Paraná and the Paraguay rivers. It is a place of importance politically and commer-

cially, but poorly built. It has several churches, two colleges and government buildings. The extensive district surrounding it produces many kinds of fruit, as well as cereals, sugar, tobacco and lumber, and its chief industry is exporting these products. Est. pop. 1930, 40,000.

CORRODENTIA or **PSOCOPTERA**, an order of small, soft-bodied insects, which includes two families. Members of one family, *Atropidea*, lack wings, or have only very tiny ones. Familiar species are the book lice, often found among old books. Members of the second family, known as bark lice (*Psocidae*) are winged. They live mainly on the bark of trees.

CORROSION, a wearing away of metals by chemical change, sometimes termed "rusting." Iron exposed to moist air forms a brownish hydroxide; copper forms a greenish carbonate; and zinc a white layer of basic carbonate and hydroxide. Most metals are in an unstable condition, and have a tendency to more stable combinations, such as reverting to their natural ores. In some cases of corrosion direct chemical combination occurs, as, when a piece of iron or copper is heated in air, a visible vari-colored oxide film is formed. Probably an invisible film forms at ordinary temperatures on initial exposure of the metal in air. The action of hydrogen sulphide on iron, commonly observed in certain oil fields, is another instance of corrosion by direct attack. Most cases of corrosion, however, occur in the presence of water, due to electrochemical action. That is to say, differences of potential or "galvanic" couples are set up, the corroding metal being the anode. The cathode is generally a more highly oxidized surface, some other more cathodic metal, or a higher concentration of free oxygen in the water which makes the more highly aerated surface cathodic to adjoining areas.

When clean iron is exposed in water, hydrogen is deposited at the cathode and forms a protective film which tends to retard and may stop the reaction. Oxygen, usually present in natural corrosion, tends to combine with and remove the hydrogen from the cathodic surface. Thus, while free oxygen is necessary for continuation of the corrosion process, it usually does not act directly, but through combining with hydrogen. Where a difference in concentration of oxygen exists on the surface of iron, the area shielded from oxygen corrodes more rapidly. The speed of corrosion, after the initial rapid attack, depends upon a number of factors, such as: local differences of potential mainly due to differences in oxygen concentration or contact with more cathodic material polarization at anode and cathode; and the formation of natural coatings on the surface of corroding metal which either retard or accelerate the rate. The actual amount and character of corrosion and damage resulting therefrom is the result of a number of such forces. Different factors exert a controlling influence in different media. Corrosion may be classified on this basis, as: atmospheric, underwater, soil, chemical, and corrosion due to stray electric currents. Variations

in composition usually influence corrosion much less than conditions external to the metal.

Corrosion prevention may be accomplished in three ways: (1) By neutralizing the action of the surrounding media so that it will be less active, or will form a protective coating on the metal surface; (2) by the use of artificial protective coating, such as paint, asphaltum or Portland cement, or (3) by the selection of a more resistant metal.

The differences between the corrosion resistances of metals usually depend upon their ability to form and maintain surface films of a protective nature (*see PASSIVITY*). Corrosion is essentially an economic problem, the practical solution of which depends on a clear knowledge of the factors involved, their relative intensity, and the relative cost of various preventive measures.

F. N. S.

BIBLIOGRAPHY—U. R. Evans, *Corrosion of Metals*; F. N. Speller, *Corrosion—Causes and Prevention*.

CORROSIVE SUBLIMATE, common name for mercuric chloride, (HgCl_2), a white solid substance. It melts at 265°C . and boils at 307°C .; will dissolve readily in alcohol and ether. It is prepared commercially by subliming a mixture of mercuric sulphate and sodium chloride. It is used as an astringent, caustic, antiseptic and also as a preservative of materials. Mercuric chloride, taken internally, is a violent poison. The white of eggs is commonly used as an antidote.

CORRUPT PRACTICES. As a result of scandals in connection with elections, legislation in England defined what might be done by candidates in furtherance of their candidacy at elections, and regulated the amount which might be spent by candidates and their supporters, requiring full reports thereof. Statutes of this sort are called Corrupt Practices Acts. They have been copied to some extent in this country. Violations of such statutes are made criminal offenses.

CORRY, a city in Erie County, northwestern Pennsylvania, situated about 30 mi. southeast of Erie, served by two railroads. It is 25 mi. from Lake Erie, in an agricultural district. The city is a shipping market, and has steel mills, furniture factories and oil field equipment plants. There is a State fish hatchery near by and there are oil wells in the vicinity. Oil was discovered here in the 1850's. Corry was settled in 1860 and became a city in 1866. Pop. 1920, 7,228; 1930, 7,152.

CORSAIRS, the name applied to Mediterranean pirates, who came largely from the Barbary coast (Algeria and Tunisia), and flourished from the 16th to the 19th century. Byron, in his poem *The Corsair*, gave a romanticized picture of such a freebooter.

CORSICA, an island of the Mediterranean belonging to France. It lies north of Sardinia and is separated from it by the Strait of Bonifacio. Corsica is 114 mi. long, about 60 mi. wide and covers an area of 3,366 sq. mi. The coast line is generally uniform except in the west where it is deeply indented. The interior is dominated by mountains which rise to heights of 7,000 to 8,000 ft., the highest peak being Mt. Cinto, 8,881 ft. above the sea.

Some of the peaks are covered with snow the greater part of the year; many streams descend from the mountains and flow in torrents on all sides of the coast.

The soil of Corsica is productive but agriculture is neglected. The vine, however, is cultivated and olives grow abundantly. Tobacco is also produced. The raising of goats and sheep and the breeding of silk worms are important occupations. The principal manufactures are macaroni, cigars, preserved citrons and gallic acid. Copper, antimony and marble are the chief minerals. The exports from Corsica include fish, fresh and preserved fruits, wood, dairy produce, tanning bark, skins, gallic acid, wine and mineral waters.

Corsica forms a department of France, with AJACCIO as the capital. Other important towns are BASTIA, Ile Rousse, Corte and Sartene. Ajaccio is the see of a bishop. Bastia is the military headquarters and contains the court of appeals. Pop. 1931, 297,235.

History. The prehistoric Ligurian population of Corsica was subjected to Etruscan, Carthaginian and Roman influences, but with the First Punic War the island became a Roman province. With the fall of the Roman Empire it was successively the spoil of many invaders: Vandals, Goths, Byzantines, Lombards, Franks, and lastly African and Spanish Saracens.

During the 10th century the Saracens were driven out and the island became a fief of the Holy See for a time under the joint sovereignty of the archbishops of Genoa and Pisa. During the 14th century the Genoese obtained full sovereignty; but they governed only to aid their trade, and the transfer of sovereignty in 1511 to the Bank of St. George of Genoa made matters worse. In 1553 Henry II of France conquered the island, but in a few years was forced to turn it back to the bank, and the unpopular Genoese misrule continued until revolt broke out in 1729. For a time the Corsicans maintained themselves; but the island was reconquered by Genoa in 1748 only to be lost again in the revolt raised by Pasquale Paoli in 1755. In 1768, the year before NAPOLEON BONAPARTE was born on the island, Genoa sold her empty title to it to France, and Paoli could make no stand against the French. For two years, in 1794 and again in 1814, the island was occupied by the British, but in both cases it was returned to France.

CORSICANA, a city in eastern Texas, the county seat of Navarro Co. It is situated 55 mi. southeast of Dallas and is served by four railroads, including the Texas Electric. Corsicana is a trade center surrounded by an enormous oil-producing region; hundreds of oil wells are in the vicinity, and refineries and oil well machinery factories contribute to the city's prosperity. Cotton, grain, fruit and truck garden produce are raised in the vicinity. Leading industries are cotton ginning and milling, cottonseed oil production, foundry work, oil refining and steel manufacture. In 1929 the factory output was worth about \$4,000,000; the retail trade amounted to \$10,607,962. The city was

founded in 1848 and chartered in 1871. Pop. 1920, 11,356; 1930, 15,202.

CORTES, HERNAN (1485-1547), Spanish conqueror of Mexico, was born of noble parents in Extremadura, Spain. After studying law for two years he set out to see the world. His ambition to go to the New World was gratified in 1504, and in the course of his travels he arrived in Cuba in 1511. Velasquez, the governor, jealous of Cortes's success with a certain lady, had him imprisoned. Later the two were reconciled and Cortes obtained permission to organize an expedition to search for Grijalva, who had been lost off the coast of Yucatan in 1517. The governor countermanded the order but Cortes merely hastened his preparations and set sail on Nov. 18, 1518, with a large expedition.

On Mar. 4, 1519 he reached the shores of Yucatan and by force and persuasion took Tabasco. He founded the town of Villa Rica de Vera Cruz and set up an independent government, recognizing only the king of Spain as sovereign. On Aug. 16, 1519 he started toward the capital of the Aztec Empire. He secured as allies the enemies of MONTEZUMA II, the Tlascalans and Cholulans. Montezuma, hearing of his arrival, sent presents and embassies, and when Cortes entered Mexico City on Nov. 8 he was received by Montezuma who placed a palace at his disposal. Cortes, however, captured Montezuma and used him as his own mouthpiece to govern the country. In Apr. 1520 he heard that the Panfilo de Narváez, sent by Velasquez to arrest him, had arrived at the coast. Cortes left Alvarado in control in Mexico City and rushed to the coast where he defeated Narváez, many of whose soldiers he incorporated into his own forces. When he returned he found that Alvarado in a panic had killed many of the Aztec nobility and that a retreat was advisable. He was forced to fight his way out and the massacre of the *Noche Triste*, sad night, of June 30 took place. Cortes reorganized his forces and on July 7, 1520 won a decisive battle. In April of the next year he began the siege of Mexico City, which capitulated in August.

Appointed governor and captain general of Mexico, he immediately set about to build up the colony, but he had difficulty not only with the Indians whom he sought to convert but with many of his own officers who rebelled against his rule. His enemies in Cuba, not having forgiven him his earlier disobediences, lodged complaints in the court against him. In 1527 Cortes went to Spain to defend himself before King Charles V, who received him well and gave him the titles of Marquis del Valle de Oaxaca and captain general of New Spain. He returned to Mexico in 1530 but most of the political power was in other hands. He lost much of his fortune in fruitless expeditions and was incensed when Coronado was given permission to search for the lost Seven Cities of Cibola. He returned to Spain in 1539 to protest but was coldly received. He took part in the ill-fated Algiers expeditions and was barely saved from shipwreck with his sons Luis and Martin. He died poor

and embittered near Seville in 1547. He wrote only the *Cinco Cartas*. P. V. S.

CORTIN, a substance produced by the outer part or cortex of the adrenal glands, first described in 1927. Animals deprived of both adrenals die in a few days or weeks unless injected with this substance, when they live indefinitely. Cortin affects many tissues of the body. Without it, the muscular and nervous systems become fatigued easily; the digestive system is upset; kidney function is reduced; growth is retarded; resistance to certain toxins is lowered; heat production falls. Cortin is a remedy for ADDISON'S DISEASE and other clinical conditions in which the adrenal cortex is deficient. See also ADRENALIN.

CORTLAND, a manufacturing city in southern New York, the county seat of Cortland Co., situated on the Tioughnioga River 33 mi. south of Syracuse; it is served by bus lines and two railroads. There is an airport. Cabbages and potatoes are raised extensively in this region which also has important dairy and Holstein cattle possessions. The chief manufactures are wire, cloth, corsets and netting, motor trucks, fishing lines and wall paper. In 1929 the estimated value of the city's manufactured output was \$25,000,000; the retail trade in 1929 amounted to \$10,515,669. Cortland is the seat of a state normal school. The land on which the city is built was included in the Phelps and Gorham purchase. Cortland was founded in 1792 and became a city in 1900. Pop. 1920, 13,294; 1930, 15,043.

CORTONA, an ancient town and episcopal see of central Italy, situated in the province of Arezzo, Tuscany, on a hill overlooking the Val di Chiana. The town has many Etruscan remains and a noted Etruscan museum. Cortona's 12th century cathedral was restored in the 18th century. In the Gothic churches of St. Domenico and St. Margherita are paintings by Luca Signorelli and Berrettini. Pop. 1931, 30,222.

CORUM or **CHORUM**, a city of Turkey in Asia Minor, capital of the vilayet of Corum and situated halfway between Amasia and Yozgat. It is the chief trading center of a region producing opium, wool and silk. Although chiefly populated by Moslems and richly adorned with mosques, Corum is a Christian shrine because St. Theodore, the warrior-saint of the Greek church who is said to have slain a dragon near the city, is buried here. Fifteen miles east of Corum is ancient Euchaita which was attacked by the Huns in the 6th century A.D. Pop. 1927, 60,752.

CORUÑA or **CORUNNA**, a city of Spain, capital of Coruña province. It is a prominent seaport and one of the leading commercial centers in Spain, well protected by nature and fortifications. Six churches and a nautical school are located here. The city produces textiles, glassware, cigars and canned goods. It exports chiefly fruit, vegetables and fish; and imports cacao, noodles, bacon, coffee, petroleum and machines. Est. pop. 1929, 67,093.

CORUNDUM, the hardest mineral known, except the diamond. It occurs in many forms, and is valuable in industry and as gems. Three varieties are

recognized: **SAPPHIRE**, including the **RUBY**; **corundum**; and **EMERY**. All have the same chemical composition, aluminium oxide, and crystallize in the **RHOMBOHEDRAL DIVISION** of the **HEXAGONAL SYSTEM**. The differences are based on purity and state of crystallization. The fine, clear variety, sapphire, may be colorless, blue, red, yellow, green or purple, called respectively white sapphire, blue sapphire, ruby, Oriental topaz, Oriental emerald and Oriental amethyst. Emery is a black or grayish opaque corundum, containing an intimate mixture of **MAGNETITE** or **HEMATITE**.

Corundum proper includes the non-transparent kinds, colored light blue, gray, brown or black. It was the original adamantite spar from India, or *adamas siderites* mentioned by Pliny, that was ground and used as a polishing material both in ancient Europe and India. Corundum usually occurs in crystals and veins in such rocks as granular **LIMESTONE**, **DOLOMITE**, **GNEISS**, **GRANITE**, **MICA SLATE** and chlorite slate.

Fine sapphires come from Ceylon; upper Burma produces rubies, and Greece and Asia Minor provide emery. Corundum comes from Canada, South Africa, Madagascar, India, and in the United States mainly from New York and Virginia. It is of use principally as an abrasive. Corundum can be produced artificially. See also **ALUMINA**; **ADAMANT**; **MINERALOGY**; **GEM STONES**.

CORVALLIS, a city in northwestern Oregon, the county seat of Benton Co., situated in the Willamette River Valley, between the Cascades and the Coast Range, 85 mi. south of Portland. It is served by bus lines, river craft and the Oregon Electric and the Southern Pacific railroads. There is an airport. The surrounding region produces diversified farm crops, timber, poultry, fruit, nuts, bulbs, and live stock. Corvallis has lumber and flour mills, wood-working factories, canneries, and creameries. The city is an important educational center, being the seat of Oregon State College, founded in 1868. This institution offers major courses of study in agriculture, engineering, commerce, home economics, forestry, mining, pharmacy, industrial chemistry, vocational education and military science. The college has valuable property used as demonstration farms, and an arboretum; it supervises many acres of State forest. Eight branches of its Agricultural Experiment Station are scattered throughout the state. Corvallis was founded in 1846; incorporated in 1857. Pop. 1920, 5,752; 1930, 7,585.

CORVUS (gen. *Corvi*), the raven, a small but brilliant constellation composed chiefly of four stars of the second magnitude arranged in a small and conspicuous quadrilateral, directly south of Virgo. See **STAR: map**.

CORWIN, THOMAS (1794-1865), American statesman, was born in Bourbon Co., Ky., July 29, 1794. Admitted to the Ohio bar in 1817, he soon became, largely due to his brilliant wit, a prominent lawyer and a leader of the Whig party. He was

sent to Congress in 1831 and remained there until 1840, when he was elected governor of Ohio. As United States Senator in 1845-50, he courageously stood with the few in opposing the war with Mexico, which he felt to be inspired by unjust imperialism. Corwin served as Secretary of the Treasury under Fillmore 1850-53, and as a Republican representative in Congress, 1859-61. He was opposed to the expansion of slavery into the territories of the Union. Lincoln appointed him United States minister to Mexico. He resigned in 1864 to return to law practice in Washington, D.C., where he died Dec. 18, 1865.

CORY, WILLIAM JOHNSON (1823-92), English educator and author, was born in Devonshire, Jan. 9, 1823, and educated at Cambridge. He won distinction as a teacher while assistant master at Eton from 1845-72, and attained a permanent place among English lyricists by his collection of poems, *Ionica*. His other writings include *Lucretius*, a treatise on writing Latin lyric verse, and *Iophon* on Greek iambs. Cory died in Hampstead, June 11, 1892.

CORYBANTES or **CORYBANTS**, in Greek mythology, the priests of **CYBELE** or **Rhea** in Phrygia. They worshiped these goddesses with wild orgies and dancing to the accompaniment of drum and cymbals. The demigods were sometimes called Corybantes. Their origin is uncertain. They may have been priests or medicine men.

COS or **KOS**, also **Stanko**, the Italian Stanchio and Turkish *Istankeni*, one of the islands of the Sporades group in the Aegean Sea, southwest of Asia Minor. Cos was the seat of worship of **Asclepius**, Father of Medicine. Hippocrates was born there. It is now a possession of Italy. Pop. 1927, 16,000.

COSENZA, a city of southern Italy, capital of the province of the same name, situated in a fertile region among wooded hills. It is the seat of an archbishop, has a 13th century cathedral with the tombs of Louis III of Anjou and Isabella of Aragon, a museum and fine schools. A massive ruined castle towers above the closely built, gloomy old city, from which extends the new city with wide streets and pretentious public buildings, banks and residences. Due to frequent and heavy earthquakes, notably in 1783, 1870 and 1908, few old buildings remain. The industry, chiefly cutlery and majolica manufacture, is of minor importance, but the trade in silk and in the agricultural products of the region is very brisk, particularly in grain, wine and olive oil, hemp and honey. Pop. 1928, 30,659.

COSGRAVE, WILLIAM THOMAS (1880-), first President of the Irish Free State, was born at Dublin in 1880, and received his education in a school of the Christian Brothers. He joined the Sinn Féin movement when he became of age, participated in the Easter, 1916, uprising in southern Ireland, and was imprisoned for one year. Upon his release in 1917, he was elected to the first Dail Eireann, which declared itself for the Irish republic. He was appointed Minister for Local Government, holding this office

until 1921. He became member of the Provisional Government in Jan., 1922, and Minister for Local Government. He was chairman of the Provisional Government, Aug., 1922, and was holding this position when, upon the deaths of Griffith and Collins in September, Cosgrave became President of the Dail Eireann, in which office he continued until Dec. 5, 1922. Upon the formation of the Irish Free State in the autumn of that year, he was made president of the Executive Council of the Irish Free State. He was reelected in Oct. 1927; but in 1932 EAMON DE VALERA was elected President. He has also held the portfolio of Minister of Finance, 1922-23, and Minister for Defense, 1924.

COSHOCOTON, a city in eastern Ohio, the county seat of Coshocton Co., situated on the Muskingum River, at the confluence of the Tuscarawas and Walhonding rivers, 70 mi. northeast of Columbus. Bus lines, airplanes and two railroads afford transportation. Coal and gas are found in this region, of which grain is the principal crop. The city has various manufactures, including advertising novelties, pottery, pipe, leather and rubber goods. In 1929 the factory output reached an approximate total of \$10,000,000; the retail trade amounted to \$6,108,677. Coshocton was founded in 1792 on the site of an Indian village, and was known as Tuscarawas until 1811, when it became the county seat. In 1833 it was incorporated. There are prehistoric mounds in the vicinity. Pop. 1920, 10,847; 1930, 10,908.

COSMETICS, preparations applied to the face and hair, for the purpose of beautifying and adorning them.

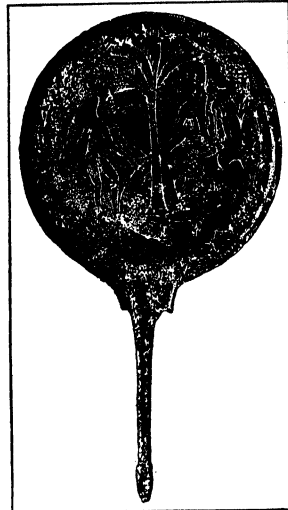
History. Decorating, correcting or improving nature's endowments of personal beauty and seductiveness seems to be a practice of the human race that begins with the very rudiments of civilization and communal life.

The progress of cosmetics falls roughly into three periods. In the *first period* the ministrations of religion, medicine and beautification are combined. In primitive societies, the priest is also medicine-man and beauty specialist. To the priests' offerings of burning aromatics to the gods, we owe perfumery. If an evil spirit has given one a deformity, it is the priest who, by rites, potions, and surgery, attempts to cast out the evil spirit and correct the deformity. It is the priest who decorates one with the tattooing and dyes that increase one's charm or perhaps indicate one's estate and prowess. The cosmetic practices of the tribal priest, however, frequently have other motives than mere beautification. Often they are to console the gods, to frighten away the evil spirit or to make one appear more terrifying to an enemy in wartime. The blue woad paint that the ancient Britons wore in battle is a case in point.

Beauty is a relative term. Therefore, it may be inexact to define the use of cosmetics as beautification. Indeed, many cosmetic fashions, even in advanced civilizations, are mutilations that seem the very opposite of beautification to modern Western eyes,

though possibly some of our practices would seem equally hideous to the people of other civilizations. Of such may be counted the fashion for curious shaped heads among the Aztecs (caused by deforming the skull in infancy), the filed teeth and platter lips of some African tribes, and the bound feet of the Chinese women.

Among peoples who advanced from the civilization of the tribe to that of the state or empire, history records that cosmetics advanced with them towards the *second period*. In such civilizations the priests confined themselves more and more to spiritual matters. Their therapeutic duties were taken over by a



COURTESY M. M. OF ART

ETRUSCAN BRONZE HAND MIRROR OF
THE 6TH CENTURY B.C.

Showing decorated reverse side

medical profession with some rudiments of scientific method. Thus cosmetics, in its second period, gradually won its freedom from the priest, but still remained under the jurisdiction of the physician, and did not achieve a status of independence.

In this period developed most of the ideas that form the basis of modern cosmetics. For instance, the Chinese had an elaborate system of massage, which was practised by blind masseurs. The Chinese were also the first to discover the virtues of goose-grease as a basic ingredient for ointments. Their pride in long fingernails was probably the beginning of the modern manicure.

Egyptian excavations have unearthed quantities of evidence of the use of cosmetics of all kinds, as far back as the first dynasty (about 4000 B.C.)—everything from perfumes to wax depilatories. There is a scroll, called the PAPYRUS EBERS, dating back to 1500 B.C., that is said to be a kind of *materia medica* of

the ancient Egyptians. Within the 22 yard length of this scroll is recorded a knowledge of hair tonic, the use of cow's blood for dye, and the oils of lions, hippopotami and even snake oil as unguents.

Cleopatra is well known for her dressing table. She used green paint under her eyes, black *Kohl* (antimony) under the lids and lashes. She also tinted her palms, finger nails and the soles of her feet with henna. A perfume called *Kyphi*, made of herbs, myrrh and frankincense, was also popular with the Egyptians. And when Tutankhamen's tomb (about 1350 B.C.) was opened, phials were found that still gave off a faint fragrance. At this period cosmetics was an industry of international importance. The chief exporting and manufacturing peoples were the Persians and the Phoenicians.

From Egypt the cosmetic cult spread to the Hebrews, the Greeks, and throughout the Eastern Mediterranean. There are many Biblical references to the

sidered as a quite separate matter from the practice of beautification. From this point on, advance followed advance. The Frangipanni's inventions founded the modern perfume industry. Farina invented eau de Cologne. Chemistry gave its dyes and lotions. Physics contributed electrolysis and the X-ray. The march still goes on to this day.

This progress, however, was not without its checks and obstacles, and the rise of Puritanism was not least among them. It was not so much the perfection of cosmetics as a science, as it was the practice of it as an art that suffered from the Puritan ideal. During Cromwell's Commonwealth in England such luxuries were frowned out of existence, though they came back with Charles II. During the age of Victoria, even up to the Great War, the use of cosmetics was not considered "nice" among the middle classes of Western civilization.

The end of the World War brought a revolutionary change in this attitude, particularly in the United States. Not only did a woman using cosmetics cease to be considered improper, but she was often actually considered old-fashioned if she did not make use of them. This change has even affected rural districts. Nothing demonstrates its extent so vividly as these figures of the rapid expansion of the American cosmetic industry since 1914.*



COURTESY M. M. OF ART

TOILET SCENE OF ANCIENT GREECE
From a piece of red-figured Apulian pottery of the 4th century B.C.

use of cosmetics by the Hebrews. The Grecian men of the classic age were such profligate users of perfume that restrictions were decreed, lest the supply for ritual purposes become insufficient.

When Greece gave her culture to Rome, she gave her cosmetics, too. And Rome carried the gift throughout her vast empire, even to the Celtic Britons on the outskirts. The Romans were even more lavish in their use of aromatics, rouge, hair dye, and powder than the Greeks. They, too, suffered restrictive decrees for immoderation.

With the decline of Rome and the advance of the barbarians, it was not until the Crusaders came back from the East that cosmetics really became established in Western Europe. At about the end of the thirteenth century A.D., we see cosmetics beginning to emerge into its *third period* (modern)—the period of independence as a separate technology, divorced from both religion and medicine. During this period, despite its separation, it has been continually enriched by the contributions of chemistry, physics, surgery and the other sciences.

Henri de Mondeville, a French physician of the time, seems to have been the man who set cosmetics on its road to independence from medicine. For it was he who first enunciated the wholly modern notion that the treatment of skin diseases must be con-

Year	Amount (Wholesale Values)
1914.....	\$34,206,000
1923.....	119,237,000
1925.....	147,393,000
1927.....	178,474,000
1929.....	201,689,000

An estimate of the relative importance of various cosmetics and toilet articles may be gained by the following figures, showing production for 1929 (census of manufacture, Department of Commerce).

Preparations	Value
Face Cream	\$33,347,464
Dentifrices	32,463,698
Perfumes and Toilet	
Waters	27,461,976
Face Powders	24,037,625
Rouges	12,308,969
Hair Tonics	10,339,232
Talcum and Toilet	
Powders	10,683,705
Shampoos	5,796,526
Hair Dyes	3,327,259
Depilatories	1,551,633
Other Preparations ...	40,377,067

Modern Use of Cosmetics. A further idea of the importance of the toilet goods industry may be gained by a brief review of the advertising expenditure over a period of years. In 1913 less than \$3,000,000 were spent in advertising, and was outranked by automo-

(* Source: Commerce Year Book, 1929. Statistical Abstract, 1930, U. S. Census Report.)

bile, food, and clothing, although each spent less than \$5,000,000. In 1929 drugs and toilet preparations ranked above all other advertisers, having spent not quite \$25,000,000 in magazines alone.

The modern aspect of cosmetics is, perhaps, interesting in its social significance. All of the important women's magazines published in the United States devote effort and editorial space in educating women about their appearance, and the correct use of cosmetics. The result of this is that being well groomed and devoting time and money to looking as beautiful as possible is gaining wide favor. *See also* BEAUTY CULTURE.

BIBLIOGRAPHY.—Herman Goodman, *Cosmetics and Your Skin*; G. W. S. Piesse, *Piesse's Art of Perfumery*; Eugene Rimmele, *The Book of Perfumes*; William Meyer, *The Cosmetics*; T. A. Poucher, *Perfumes, Cosmetics and Soaps*; George Wm. Atkinson, *Perfumes and Cosmetics*; W. A. Pusey, *Care of the Skin and Hair*.

Medical Aspects of Cosmetics. Practically all cosmetics on the American market, sold by manufacturers of national repute, are wholly free from harmful ingredients. This includes such preparations as face creams and powders, rouge, compacts, eye-brow pencils, lipsticks, hair lotions and skin deodorants. Certain classes of cosmetics, even though put out by reputable manufacturers, may be dangerous. Among these are those hair dyes of other than purely vegetable origin, some of the so-called freckle removers, and a few of the substances sold for the removal of superfluous hair. Dyes with an aniline base may produce, in susceptible persons, a serious skin irritation; the lead-salt-and-sulphur hair dyes may be absorbed, with the production of chronic lead poisoning (plumbism); the pyrogallol-metallic salts dyes may also poison the user, while the silver-salts dyes may, in rare cases, if absorbed, produce a condition known as argyria. There is no substance known that will restore the natural color of the hair. All preparations sold under such a claim act by dyeing the hair, so as to simulate the original color. The dangerous element in some "freckle removers" is ammoniated mercury, a caustic that acts by removing the outer layers of the skin. In susceptible persons, or if left on too long, such substances may eat into the deeper tissues. Hair removers (depilatories) that contain alkaline sulphides may do damage. Such depilatories come in the form of liquids, powders, or pastes, and have the unpleasant odor common to the sulphides, masked by some heavy perfume. They act by the power of the sulphides of dissolving horn-like substances, such as hair. As the structure of the outer skin is practically identical with that of the hair, it is evident that a substance that is powerful enough to destroy the one may injure the other. Comparatively recently, there have been marketed alleged depilatories containing thallium acetate. This substance is a very powerful poison and many cases of severe illness have been reported following the use of thallium-acetate depilatories. While the absorption of thallium acetate may cause a complete loss of hair over the body, the hair is not permanently destroyed,

and if the patient lives, it will return. Those who purchase the ordinary cosmetics from the large concerns that advertise in a national way are virtually certain to get products that are quite harmless. *See also* DERMATITIS.

A. J. C.

BIBLIOGRAPHY.—American Medical Association, *Cosmetic Nostrums and Allied Preparations*; Arthur J. Cramp, *To Dye or Not to Dye*, *Hygeia*, July, 1924; Arthur J. Cramp, *Some Cosmetic Hazards*, *The Woman Citizen*, August, 1927.

COSMIC DUST, the name given, in astronomy, to the finely divided particles which pervade interstellar space. In the neighborhood of the solar system it averages only about one ounce per billion cubic miles. In some regions of space, however, this cosmic dust may be concentrated to such an extent that it obstructs the passage of light, and obscures the view of distant objects behind. It thus becomes visible as a dark NEBULA.

COSMIC RAYS, radiation which is originated in interstellar space by the combination of hydrogen ATOMS to form the common heavy elements, helium, oxygen, iron and silicon, according to the theory proposed by R. A. MILLIKAN after considerable experimental work. Data obtained by Millikan indicate that this radiation from the depths of space enters the earth's atmosphere as PHOTONS, or pure ether waves, and not as streams of ELECTRONS; that the rays are of uniform intensity in all directions and latitudes and are independent of sidereal time; and that the radiation is not affected in any way by the sun, the milky way or the nearest spiral nebula, *Andromeda*.

The theory of the origin of cosmic radiation is based upon the fact that the heavier elements exist in interstellar space, that their synthesis would produce radiation of the nature of the cosmic rays and that the temperature and pressure of the sun and stars, as presumably maintained by the atom-annihilating process proposed by Jeans and Eddington, are prohibitive to the atom-building processes. Millikan believes that the hydrogen from which the heavier elements are formed in interstellar space is somehow being replaced by radiant energy from the stars, although the truth of this theory has been doubted by Jeans. The theory that the radiation originates in the depths of space is supported by the fact that the rays enter the earth's atmosphere as photons, which means that they can not have passed through any appreciable quantity of matter before reaching the atmosphere. That the rays do enter the atmosphere as photons, and not electrons, is indicated by the fact that they are not affected by the earth's magnetism, i.e., the radiation is of the same intensity near the poles as elsewhere. The *neutron*, discovered by James Chadwick in February, 1932, has been advanced as a possible explanation of cosmic rays, but this theory has not been substantiated thus far.

Extensive measurements of the cosmic radiation intensity by Millikan by means of a very sensitive electroscop show that the mean intensity for the earth near sea level is about 28.3 ions per cu. cm. per sec. The intensity varies with fluctuations in the thickness

of the atmosphere through which the rays pass, due to absorption. This fact indicates that the electroscope may have possible future use in meteorology, being more accurate than the barometer for determining the thickness of the atmosphere.

Upon passing through the atmosphere, the cosmic rays effect IONIZATION, and the ionization depth curves computed by Millikan from experimental data show that the radiation is composed of bands of different WAVE-LENGTHS. The most intense and least penetrating band is supposed to be due to the photon released when four hydrogen atoms combine to form an atom of helium. Also, the cosmic ray curve is found to be substantiated by the theory that the radiation is composed of four bands due to formation, out of hydrogen, of the four groups of elements, helium, oxygen, silicon and iron. The softest cosmic ray band, that of helium, is five times as penetrating as GAMMA RAYS.

The absorption coefficients of cosmic rays vary from $\mu = 0.25$ per meter of water to $\mu = 0.15$. Using Compton's equation, the wave-lengths corresponding to these coefficients are 0.000525\AA and 0.00032\AA . Thus, the frequencies of the cosmic rays are about 50 times that of ordinary gamma rays, whose wave-length is 0.025\AA . The shortest cosmic ray wave-length corresponds to an energy of 32,000,000 volts. Millikan recently used the energy of these rays to break down the atom for the first time.

The effect of cosmic radiation on the earth is to ionize the atmosphere and, possibly, to maintain the earth's charge (see TERRESTRIAL MAGNETISM). About 40% of the ionization of the atmosphere at the earth's surface, over land, is due to cosmic radiation and at great altitudes, where the earth's radioactive rays are not effective, the ionization is entirely due to cosmic rays. Thus, cosmic radiation undoubtedly has considerable effect on atmospheric electrical effects (see ATMOSPHERIC ELECTRICITY).

BIBLIOGRAPHY—R. A. Millikan, *Physical Review*, v. 36, p. 1595, *Astronomical Society of the Pacific*, v. 43, June 1931; R. A. Millikan and G. H. Cameron, *Physical Review*, v. 37, p. 235.

COSMOGONY, the theory of the origin of the universe. This term is usually used to connote the early mythological accounts of various peoples in contradistinction to COSMOLOGY. Well-developed cosmogonies appear to be the product of comparatively advanced thinking. North American Indians and South Sea Islanders have elaborate systems of cosmogenic myths though legends of this sort are scant among South American Indians and apparently absent among the aborigines of Australia. Among the ancients the Greeks had the most elaborately beautiful and imaginative theories explaining creation. Certain basal principles are present in all primitive cosmogonies. The universe is invariably evolved from the fewest possible elements and is produced by a single act in its finished state with no accounting for subsequent development and evolutionary processes.

According to various cosmogonies the universe was created by a spiritual being such as the Greek Zeus or the Egyptian Ptah, or Night; or by such material elements as air, water and ether. A cosmic ocean is the primal cause in certain Babylonian and Hindu myths and in some Egyptian legends a cosmic egg, fashioned from mud of the Nile. X.

In astronomy, cosmogony deals with the problem of the origin and the evolution of the stars, the solar system and the earth. The older theory of the origin of the solar system held that it was formed out of a huge rotating nebula, which, as it contracted and rotated faster and faster, threw off rings of matter which eventually condensed into the planets. This theory, often called the nebular hypothesis, has been shown mathematically to be untenable and is now replaced by the planetesimal hypothesis or theory of dynamic encounter which assumes that the planets originated from the close approach of a star to the sun. Enormous tides were raised on the sun and a great quantity of matter ejected. As the star receded the ejected material was set into revolution about the sun. The planets were formed out of this circulating material. This is only a very general outline, and the actual detailed explanation of the genesis and the subsequent development of the planetary system is beset with many difficulties.

The question of the origin and the evolution of the stars is in a less satisfactory state, there being no theory capable of explaining all the observed facts. It appears likely, however, that a star originates as a huge red giant, enormous in size, exceedingly tenuous, very luminous, and rather cool. With the passage of time such a star contracts and heats up, gradually becoming yellow, then white in color, and finally even blue. When it has reached this point, the star radiates so much energy into space, that although it continues to contract, it cools off, and again passes through the stages of being white, yellow and finally red in color. It now steadily decreases in size, becomes a dwarf, and ends its life as a red dwarf star. The time scale of this stellar evolution appears to be of the order of trillions of years at least, most of which time is spent in the dwarf stage. The place of the sun in this scheme is somewhere among the yellow dwarfs, definitely on the down grade as far as splendor is concerned, but possibly with more than half its life still before it. W. J. L.

COSMOLOGY, the philosophical conception of a world order, the philosophy of nature. Cosmos is the Greek word for order, and was distinguished from chaos, or the lack of order. The mere fact that the world should be regarded as a cosmos indicates that early speculation saw in it some form of order. Cosmology, which is an attempt of speculative thought to understand the world, differs from cosmogony, a preceding concept, in that the latter was largely mythological in its explanations. Modern cosmology has, of course, been influenced by science, with the latest findings of which its conceptions must reckon. Thus the principle of evolution plays a most important part

in present-day cosmology. The origin, development and purpose of the world are typical cosmological problems.

COSMOS, a genus of showy herbs or subshrubs of the composite family, closely allied to *COREOPSIS*. There are about 20 species native to tropical America, chiefly Mexican, several of which are cultivated as late-flowering ornamentals. The common cosmos (*C. bipinnatus*), a smooth annual, 7 to 10 ft. high, bears very deeply cut leaves and large showy flower-heads with white, pink or crimson rays surrounding a yellow disk. The smaller yellow cosmos (*C. sulphureus*), a slightly hairy, much branched annual, 4 to 7 ft. high, bears golden-yellow flowerheads sometimes 3 in. across, on long leafless stalks. The black cosmos (*C. diversifolius*), which grows from dahlia-like tubers, rises about a foot high bearing dark velvety red or purple flower-heads.

COSSACKS, the name of a people in southern Russia who have lived for several centuries under conditions of special privilege allowed them in return for military service. A mixed race, with the Russian element predominating, they began about the middle of the 15th century to constitute outposts of the Slavs on the frontiers towards the Tatars, especially on the Dan, Dnieper, Volga and Ural rivers and the steppes north of the Caucasus. There they became permanent frontier police, living in military communities that were long semi-independent. Military service was compulsory and began at eighteen. Their free, out-of-door life developed qualities that made them famous as irregular cavalry. Since land holding was communal for all until the statute of 1869 gave officers and civil servants landed property, the innovations under Bolshevik rule have not been so startling as elsewhere, though the decree of June 1, 1918 put the Cossack community on the same basis as the rest of the population.

COST ACCOUNTING, that division of business records which compiles and analyzes the costs of manufacturing products, performing operations, or rendering services. Originally applied mainly in manufacturing to signify the adding together of the items in the cost of a product, it now includes all forms of analysis to measure financial results in any field of business. In this larger sense the term "industrial accounting" is often used. The chief elements in the cost of a manufactured product are direct materials, direct labor, and burden or indirect expense; the latter involving apportionment of expense to the appropriate departments and products, and an assumption as to the volume of business. The main purposes of cost information are, (1) to set selling prices, (2) to measure operating efficiency, (3) to regulate and value inventories, (4) to control financial operations. In planning the future from experience of the past, standard costs and budgeting appear. Standard costs imply the setting of certain standard figures and afterwards comparing with them the actual costs. In budgeting for a business much of the needed information is supplied by cost accounting.

T. H. S.

COSTANOAN, a North American Indian linguistic stock which occupied the coast of central California, from the ocean to the San Joaquin River and from the Golden Gate and Suisun Bay on the North to Point Sur on the Coast and to some distance south of Soledad in the Salinas Valley on the south. The stock was classified into a dozen or more groups which were not, however, true tribes. The Costanoan peoples were typical central Californians, placing their chief dependence for food on acorns and seeds, though fish, deer and other game were part of their diet. They lived in grass or tule houses, wore scant clothing, made balsas or rafts of tule for water transportation and wove baskets. They were converted by Franciscan missionaries late in the 18th century. In 1834 the Indians were scattered after confiscation of the missions by the Mexican government. It is assumed that the few scattering survivors of this stock still existing have been entirely Mexicanized.

COSTA RICA, a republic of Central America, south of Nicaragua, north of Panama, west of the Caribbean Sea and east of the Pacific Ocean. The area is about 23,000 sq. mi. The chief city and capital is San José, and Limón the principal port on the Atlantic and Puntarenas on the Pacific.

Between the low-wooded Atlantic seaboard and the llanuras or savannas of the Pacific slope a rugged tableland with a mean elevation of from 3,000 to 4,000 ft. occupies the whole of the interior, and is traversed throughout its entire extent by a lofty range running midway between the two oceans. This range, which maintains an average altitude of over 6,000 ft., is dominated at intervals by a long line of lofty cones and peaks rising from 7,000 to over 11,000 ft. above the sea. Most of the peaks are volcanoes, either long extinct, now quiescent, or still active. Irazú, 11,500 ft., is the highest peak.

The greater part of the inhabitants have been fused in a somewhat homogeneous Ladino population of Spanish speech and culture and of Costa Rican nationality. As shown by the comparatively tranquil course of events during the independence period they are certainly a more peace-loving and steady-going people than most other Spanish-Americans. The majority are well-educated and highly intelligent. There is also a peasant proprietor class consisting of hard-working, sturdy farmers who are owners of small coffee plantations. The people are concentrated chiefly in the fertile and salubrious volcanic districts of San José, almost under the shadow of Turrialba, Irazú and the other giants of the igneous range.

Because of its position between two oceans, Costa Rica enjoys an essentially marine climate, which, however, is modified in various ways by its general elevation and other local conditions. Thus the mean annual temperature falls from about 80° F. on both of the low lying seaboard to 70° or less at San José and in most of the other inhabited upland districts. Dry winds prevail on the Pacific, and moist on the Atlantic slopes, with the result that although the temperature is higher on the west side it is more

COSTA RICA



1, 2, COURTESY CONSULATE GENERAL OF COSTA RICA, NEW YORK; 3, 4, UNITED FRUIT CO.

CHARACTERISTIC SCENES IN COSTA RICA

1. The Temple of Music in San José, the capital city.
2. House of the Bishop of San José, fronted by a tropical garden.
3. Talamanca Indians shooting fish with bows and arrows.
4. Typical "ranchito," or native hut, raised on posts and roofed with grass.

COSTA RICA



COURTESY UNITED FRUIT CO

RAISING BANANAS IN COSTA RICA

1. Banana plantation of Costa Rica in production
2. Sling of fruit hanging ready for "packing"
3. "Packing" bananas, by animal and man, on way to transportation center
4. Loading bananas on railway cars, for transportation to coast.

oppressive on the Caribbean coast lands. Costa Rica, in general, is one of the healthiest tropical countries in the New World.

A yearly rainfall exceeding 100 in. on the eastern slopes supports a very rich forest vegetation comprising many valuable species such as ebony, mahogany, evergreen oak, brazilwood, and cedar. Grassy savannas prevail on the Pacific and northern llanuras, and the rich volcanic soil of the San José and Cartago uplands is admirably suited for the cultivation of tropical fruits and plants. Coffee and bananas are the chief crops. The value of banana exports in 1929 was \$6,329,000, and coffee amounted to \$12,225,000.

The Costa Rican fauna, in which the tapir and other South American forms are represented, is rich in reptiles and birds. Over 130 known species of reptiles and batrachians are found, and all the surrounding waters are well-stocked with fish and other aquatic life. The valuable pearl and mother-of-pearl oysters are among them. Toucans, humming birds, parrots and members of the gallinaceous family occur in great variety, and ornithologists have described over 400 genera and about 700 species of birds. Among the Simians is a species of white-faced monkey.

On the Pacific slope occur rich gold and silver ores. Some years ago Abangarez gold field yielded \$2,000,000. The gold and silver production in 1926 amounted to \$520,508.

Costa Rica has enjoyed more peaceful times during the period of independence than any of its sister republics. Est. pop. 1930, 516,031.

HISTORY

On his fourth voyage, 1502, CHRISTOPHER COLUMBUS discovered Costa Rica, and left a party headed by his brother Bartholomew to begin a settlement. This first attempt was repulsed by Indians; but the region was conquered and in the possession of Spanish soldiery by 1530. Costa Rica was administered as a part of the captaincy general of Guatemala; the city of Cartago, founded by Juan Vasquez de Coronado in 1562, was the provincial capital. Before the 18th century, neglected by the mother country, the colony vegetated as a remote, isolated agricultural community. The search for gold brought disappointing results; under the rigors of forced labor the coastal tribes were decimated. In the 18th century extensive cacao plantations were operated and a diverse maritime commerce conducted; but Indian wars and piratical depredations took heavy toll of the colony's resources.

Costa Rica proclaimed its independence of Spain on Sept. 15, 1821, but was unable to resist the authority of Iturbide's Mexican empire. The country joined the United Provinces of Central America in 1824, and seceded in Nov., 1838. Braulio Carrillo, president at the time of secession, attempted in 1841 to make himself dictator. Liberal leaders invited Francisco Morazan, the radical executive of the United Provinces from 1829-39, to head a revolution. Morazan, victorious, was elected provisional executive by a

constituent assembly at San José in July 1842, but in a counter-revolution in September was captured by reactionaries and executed. A period of uncertainty and constitutional experimentation ended when in Nov. 1849, Juan Rafael Mora became president. The relation of the Roman Catholic Church to the State became the leading political issue; in 1871, after a Liberal president had been deposed by a *coup d'état* and a temporary dictatorship established by Tomás Guardia, dominant politician of Costa Rica from 1870-82, a foe of the great families which had hitherto monopolized the offices, a new constitution was adopted, making Roman Catholicism the State religion but extending toleration to most other faiths. This document, establishing a centralized system of local government and providing for indirect elections of congressmen and the chief executive, remained the fundamental law until 1917, when Federico Tinoco seized the reins of government, interrupting the usually peaceful course of internal politics in Costa Rica. The only serious external problems have been boundary disputes with Nicaragua and Panama; these were settled by international arbitration.

BIBLIOGRAPHY.—For the five republics of Central America, see H. H. Bancroft, *History of Central America*, 3 vols., 1883; W. H. Koebel, *Central America*, 1917; D. G. Munro, *The Five Republics of Central America*, 1918; M. W. Williams, *The People and the Politics of Latin America*, 1930.

COST OF LIVING. The rapid rise in retail prices during and immediately following the World War, accompanied by a lag in the increase of WAGES, drew special attention in Europe and America to the cost of living. INDEX NUMBERS were constructed to show as precisely as possible changes or differences in prices of commodities and services entering into family expenditures. Determination of the cost of living of a group or class at any one time emphasizes budgetary inquiry, and is usually expressed in terms of MONEY. Changes in the cost of living over a period of time, and differences between places and social groups, are ordinarily expressed by means of index numbers. Time comparisons are the most common, and they oftenest refer to the cost of living of wage earners. A basic budget is made up, either from ascertained consumption of typical families, or from other sources; each object of expenditure is assigned its proper importance, i.e., is weighted either by ascertainment of actual expenditure or by assumption, according to the extent to which it enters into the budget; in a time series the cost of this budget at a given time is assumed to be equal to some magnitude, usually 100, and increases or decreases in time are expressed as relatives of this base. The base chosen should not be marked by unusually high or low prices, and, unless prices around the base were stable, the base should be an average for a period rather than a single point of time. Studies of the total cost of living should consider expenditures falling under five major heads—food, housing, clothing, fuel and light, and miscellaneous, the last including furniture, insurance, recreation, transportation, medical care, tobacco and the like. Unless the budget is constructed

to include every expenditure, weighting must be applied not only to individual items, but to the groups of items, for the proportion of income spent for food or sundries, say, varies with different social groups or classes, with the same class in different places, at different times, and with different amounts of income.

The cost of living in the United States moved sharply upward from 1913 until in June, 1920, it was more than twice that of the former date (216.5 as compared with 100 in 1913); prices then went down until Sept., 1922 (when they stood at 166.3), falling more rapidly than they had risen but not reaching the level of 1914; prices then rose until Dec. 1925 (177.9), the rate being much slower than in the two preceding movements; they then fell (being at 160.7 in Dec. 1930), with seasonal variations more marked than in the previous price movements, and the downward trend being accelerated after Dec., 1929. Comparing the year 1913 with Dec. 1930, food prices increased least, 37.2%; rent next, 46.5%; clothing next, 53%. Between the peak of prices in June, 1920, and Dec. 1930, clothing decreased most, 46.8%, and food next, 37.4%. Comparative figures for different countries must be accepted with caution due to difference in construction of the index numbers; on the base of 100 in 1913, in Dec. 1930 the United States stood at 161, the United Kingdom 155, and (Nov. 1930) Canada 152, Germany 144, Switzerland 157, Italy 525 (Milan, Oct. 1930), France 592 (Paris, Sept. 1930). All of the above figures are from the reports of the U.S. Bureau of Labor Statistics. The cost of living series of the National Industrial Conference Board is based, except for food, on prices collected in more localities. Curves of the two series parallel each other in the main, with the former moving on somewhat the higher level.

B. M.

BIBLIOGRAPHY.—Monthly Labor Review of U.S. Dept. of Labor, vol. 32; National Industrial Conference Bd., *The Cost of Living in the U. S. 1914-1929*.

COST OF PRODUCTION, may mean either the sacrifices (real costs) involved in the labor and saving of CAPITAL necessary, or the money expenses incurred by ENTREPRENEURS, in production. Formerly real costs were more prominent in economic literature than now. While an important type of analysis still concerns itself with real income and "human" costs, most present-day economists prefer to confine their attention to the MONEY expenses of production. Reduction of money costs, provided it does not reduce consumer purchasing power, is sound business and social policy. Increased efficiency, through better use of the factors of production and elimination of business wastes, should be reflected in real costs and real income. The higher the efficiency, the more goods society can secure for a given expenditure of effort. Much attention is accordingly given to factorial proportion, with its increasing, decreasing, and constant costs; plant utilization, with its load, capacity, and diversity factors; and size of plant, with its problems of overhead costs and unused capacity. The important distinction between overhead and special costs is

followed into its many ramifications—engineering problems of plant efficiency, business problems of financial and marketing costs, and far-reaching problems of world economics. Distinction between technological, or physical-production, costs and business costs is more emphasized than formerly. While physical costs have been lowered greatly, reduction of the heavy burden of financing and marketing costs is an outstanding task of business organization.

Cost has fundamental significance in relation to price of product and the distribution of income. Under free price-competition, according to classical doctrine, normal price would be determined by cost of production, though by whose cost was not clear. Leaving aside agricultural products, the price of which was supposed to be determined by their cost of production on marginal land, price was said to depend on average cost. Later, when differences of cost between different producers received more attention, price was by some economists regarded as determined by the marginal firm, by others, following the lead of ALFRED MARSHALL, by the representative firm. During the World War, the concept of bulk-line cost was introduced. It is the cost at or below which the bulk of the output (say 80 or 90%) of an industry is produced, the rest being the product of high-cost or marginal firms. In general, it is now recognized that the marginal firms do not control price, but follow the lead of the large concerns if they can. If they cannot, they go out of business.

With the rise of combinations and monopolies, and the practise of charging what the traffic will bear, the price of the product may have only a distant relation to cost. To restore a closer connection between the price of goods and the money cost of their production is a fundamental task of economic reform, the accomplishment of which must rest upon some effective means of control. Whether this can be achieved or not, and whether there is free competition, monopoly or some socialistic organization of production, cost analysis will remain an essential aid to technological and business efficiency.

A. B. W.

COSTUME, THEATRICAL. See THEATRICAL COSTUME DESIGN.

COTINGA, the name applied to a group (*Cotinginae*) of small tropical South American birds of the chattering family (*Cotingidae*) noted for their extraordinarily brilliant plumage. There are some 40 species of typical cotingas ranging from about the size of an English sparrow to that of a robin, all strictly forest dwellers subsisting very largely on fruits and seeds. Noteworthy species are the blue cotinga (*Cotinga caerulea*), the male of which is ultramarine blue above the reddish purple beneath with glossy black wings and tail; the similar banded cotinga (*C. cincta*) with a band of blue across the reddish purple of the breast, and the Holy Ghost bird (*Carpodectes ntidus*), which is nearly pure white. See also COCK-OF-THE-ROCK; UMBRELLA BIRD.

COTONEASTER, a genus of woody plants of the rose family, native to temperate parts of the Old

World. There are about 40 species, several of which are grown for their handsome fruit or for their attractive foliage, which displays brilliant colors in autumn. They are mostly shrubs, rarely treelike, usually with numerous small often evergreen leaves and many inconspicuous white or pink flowers.

COTOPAXI, a volcanic peak of the Andes, in Ecuador, about 60 mi. northeast of Mt. Chimborazo, in $0^{\circ} 43'$ S. lat. and $78^{\circ} 40'$ W. long. It rises to a height of 19,613 ft. and is one of the most beautiful summits of the Andes, being a perfectly symmetrical truncated cone, turned as if with a lathe. The cone itself is about 6,000 ft. high, its eastern side being snow-clad while its western is nearly bare, a contrast due to the Atlantic trade winds which sweep up the Amazon valley and deposit their moisture in the form of snow on the slopes facing eastwards.

Cotopaxi was scaled for the first time in 1880 by Whymper, who found that much of the ascent was a mere walk, no climbing being necessary. He described the crater as an amphitheater 2,300 ft. from north to south and 1,650 ft. from east to west, with a rugged crest surrounded by overhanging cliffs, some snow-clad, others encrusted with sulphur. The explorer stated that cavernous recesses belched forth smoke and that the sides of the cracks and chasms no more than halfway down shone with ruddy light. So it continued on all sides downward, precipice alternating with slope, the fiery fissures becoming more numerous as the bottom was approached. Steam undoubtedly plays a large part in the convulsions of Cotopaxi, and the quantity emitted is occasionally remarkable. Discharges of ashes have covered the lesser vegetation for miles around the slopes. The earliest eruptions of Cotopaxi have been destructive, and an outburst in 1877 did considerable damage.

COTSWOLD HILLS, a range of hills in the middle western section of England, part of the Oolites, rising from 600 to 1,100 ft. in height. The hills extend mainly through Gloucestershire and divide the basins of the Severn and Thames. The landscape is marked with rolling forest land, valleys and bare places in the highest parts. Sheep raising in this region has produced the famous Cotswold breed.

COTTER'S SATURDAY NIGHT, THE, a popular narrative poem by ROBERT BURNS, depicting the simple life of a Scotch cottager. The poem, published in 1786, describes the reuniting of a family at the week-end, tells of the suitor who comes to woo the daughter of the house, and gives scenes of homely humor and fireside devotion.

COTTON, several species of plants of the mallow family, extensively cultivated in tropical, semi-tropical and warm temperate climates for the lint attached to their seeds. The two species grown in the United States are *Gossypium hirsutum* to which belong the upland cotton varieties, and *G. barbadense*, progenitor of the Sea Island and Egyptian kinds. In India the varieties are probably descendants of *G. herbaceum*.

In frostless climates these species and their varieties

would be perennials but under cultivation they are grown as annuals. They form shrubby plants 2 to 10 ft. tall, bear white flowers which turn yellow in Sea Island varieties and red in upland kinds and which resemble those of the related hollyhock and okra. Each flower is surrounded by three, four or five deeply cut bracts which form the "squares" and is followed by a three to five-celled boll or seed pod which bursts when mature and exposes the lint-covered seeds. Each fiber is a twisted hair-like single cell less than one-thousandth of an inch in diameter.

Cotton has been used since time immemorial, its culture antedating the earliest historical records. Cotton fiber is definitely known to have been used in Egypt more than ten centuries before Christ. Since then cotton has become the leading fiber crop. It is also one of the principal crops of the world and the most extensively manufactured. Until the middle of the 18th century the lint or wool had to be separated, spun and woven by hand. Between 1750 and 1800 various machines were invented, launching what has since become the most diversified industry of the world. This is evidenced by comparing the number of bales produced in former times with that of to-day. In 1792 historical records show that the American crop was less than 6,000 bales of 500 lbs. each. In 1860, just before the Civil War, the crop was 4,483,311 bales. During the war production practically ceased, but at its close the crop was again grown with steadily increasing extent. The yield in 1900 was 10,123,000 bales; in 1910, 11,609,000 bales; in 1920, 13,440,000 bales; in 1930, 14,243,000 bales.

In the early days of cotton-growing the seeds had no value except for planting, but to-day a large proportion of the return from the crop is derived from them. At first the seeds were used as manure; then analysis proved that about 7% of the oil they contain is valuable in cookery, soap-making and the arts. The pressed cake when ground was used as fertilizer and later found to be valuable as stock food. Prior to pressing, the seeds are reginned to remove the fuzz. This is used in upholstery and felt-making. The hulls are next removed and utilized for cattle feeding and other purposes. A ton of seed yields about 40 gal. of crude oil. Cotton roots yield a chemical whose action resembles that of ergot. Bags and coarse carpet are made from the bark of the stems.

Cotton breeding is almost wholly neglected by planters, most of whom use any seed at hand. Breeding methods are so simple, inexpensive and profitable that every planter should practice them. The grower should proceed in the following manner. 1. A one or more season test of all available varieties to determine which one does best under the local conditions. 2. Growing this best variety during the second year in a large field of as uniform soil as possible. 3. Selection of about a hundred of as nearly ideal plants as possible just before picking—stocky ones of medium height that bear most of their bolls on the lower branches early in the season and that yield the largest amount of lint. 4. Saving seed of each

of these selected plants separately in numbered bags for sowing the following year in an area apart from the general field, preferably in the center of a large corn field, to prevent crossing with the ordinary plants. The seed from each plant should be sown in a row by itself for comparison of the progeny of each as to quantity of lint, length of fibers and so on. 5. Saving the seed of the best plants in each row each succeeding year for repeating the process, the balance of the seed to be used for general field sowing. 6. Keeping records of the behavior of each plant and the product of its progeny for further annual selection.

Though cotton does not draw excessive quantities of plant food from the soil it adds little humus; hence its continuous planting on a given area will impoverish even the richest soil. To replace this loss it is essential to grow abundant green manures, especially of legumes such as cow peas and velvet beans after a small grain and also with the corn, the grain to be fertilized with potash and phosphoric acid, the corn heavily manured. The growing cotton should also be fertilized preferably below the seed in the rows, from 250 lbs. to the acre on ordinary land up to 1,000 lbs. on poor soils. On virgin lands and lands where legumes have produced well, superphosphate alone often will serve as well as a mixed fertilizer. Potash has been proved of little or no benefit in cotton growing in several states.

Picking usually begins in hilly sections of the Gulf States in early September, is greatest in mid-October and least in November. In lowlands it generally starts later and lasts longer. Usually about 20% of the crop is gathered in the first picking, 50 to 60% the second and the balance at the third which is usually the last picking.

For best results the picked cotton should be allowed to dry thoroughly before being ginned, although the usual practice is to gin it as soon as it is gathered. The dried cotton gives a clear white product that commands the highest price; the damp a discolored and inferior one.

COTTON PRODUCTION, U.S.

5-Year Average, 1926-30

Division	Acreage Harvested (1,000 Ac.)	Production (1,000 Bales)	% of Prod.
UNITED STATES	44,715	14,896	100.0
LEADING STATES:			
Texas	17,354	4,625	31.0
Mississippi	3,907	1,627	10.9
Alabama	3,580	1,327	8.9
Georgia	3,752	1,319	8.9
Arkansas	3,655	1,228	8.2
Oklahoma	4,171	1,212	8.2
Nor. Carolina	1,816	890	6.0

Cotton is marketed in bales of about 500 lbs. each. The old style bales are the most cumbersome of all commercial packages. Round bales of more recent introduction are steadily gaining in popularity because of their neatness and comparative ease of handling.

M. G. K.

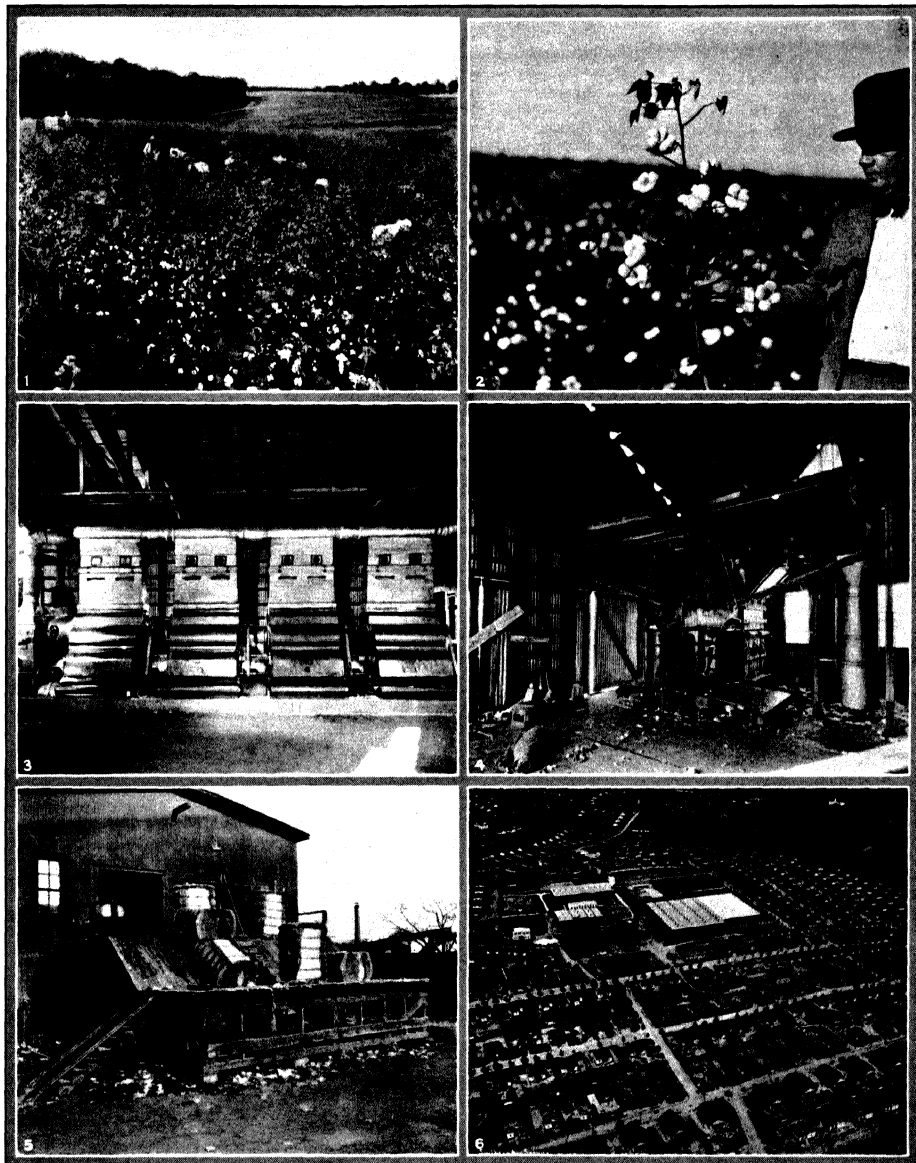
COTTON BELT, the name given to that section of the southern United States which grows more than three-fifths of the cotton of the world. This area extends from eastern North Carolina to west central Texas and covers about 700,000 sq. mi. in 16 states. A mean summer temperature of 77° and an average of 200 days free from frost determines the northern boundary. The southern boundary is determined by the amount of autumn rainfall, which must be less than 11 in. to insure favorable conditions for picking and avoid damage to the lint. The southern boundary however is moving gradually northward due to the increasing mildness of the winters and resultant lengthening of the period of the boll weevil's activity. Greatest productivity is centered in a zone embracing eastern North Carolina, part of South Carolina, Georgia, Alabama, Mississippi and sections of Arkansas, western Tennessee, northern Louisiana, southern Oklahoma and much of northeastern Texas. The banner states in production are Texas, Georgia and South Carolina. A new development in the plains and panhandle sections of northwest Texas has taken place since 1920. This region, though at a high altitude and semi-arid, is practically free from the boll weevil pest and has other compensating features which make it highly productive of an excellent grade of cotton.

COTTON BOLL WEEVIL, a small brown snout-beetle of the family *Cuculionidae*. It is the worst insect enemy of cotton. Both larvæ and adults eat the substance of squares and bolls, which die or fail to produce fiber. Adults emerge from hibernation in spring and lay eggs in the squares. Many of the infested squares fall to the ground. Soon a second brood appears, and three or four other broods follow. The later broods lay the eggs in the bolls, where the larvæ cause the destruction of the fiber; many adults are winter-killed. The most important control measures are to burn all plants and refuse immediately after harvest, thus destroying the winter shelters of the adults. Infested squares should be collected and destroyed. Calcium arsenate applied as dust early in the season and repeated at intervals is effective. Poisoned syrup applied to the buds has also proved efficient as a means of control.

COTTON BOLL-WORM, a very destructive pest throughout a large part of the cotton belt. It feeds on foliage, bolls and stalk of the cotton plant, doing most damage in the bolls. In the north it attacks corn. See CORN EAR-WORM.

COTTON GINS, machines for removing cotton seeds from lint or fiber. As invented by ELI WHITNEY in 1794, the cotton gin had to be fed by hand and the resultant product handled by hand, but the modern gin is practically automatic. In the operation of the modern gin the seed cotton is elevated from the truck by suction, dropped on to a conveyor belt and distributed to the various gin stands. From the stands it is fed uniformly onto picking rolls, which pick burrs and sticks from the cotton and present it to the saws which project through the huller ribs. The

COTTON

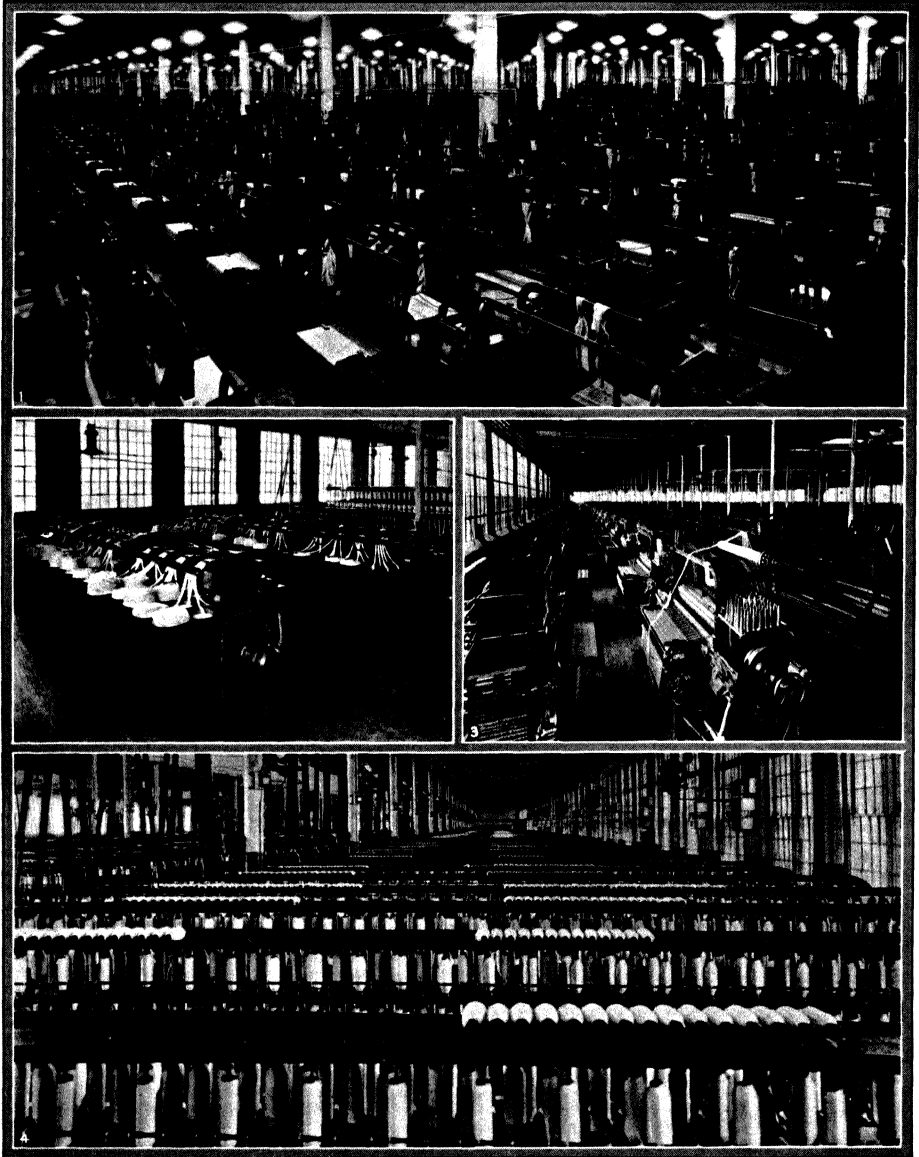


COURTESY GREENVILLE (S.C.) CHAMBER OF COMMERCE. PHOTOS FROM JAMES HUNTINGTON

COTTON GROWING AND MANUFACTURE

1. Laborers picking cotton near Greenville, S. C.
2. A cotton plant.
3. Modern cotton gins.
4. A cotton press after the bale has been removed.
5. Cotton bales ready for market.
6. Greenville, an important cotton center.

COTTON MANUFACTURE



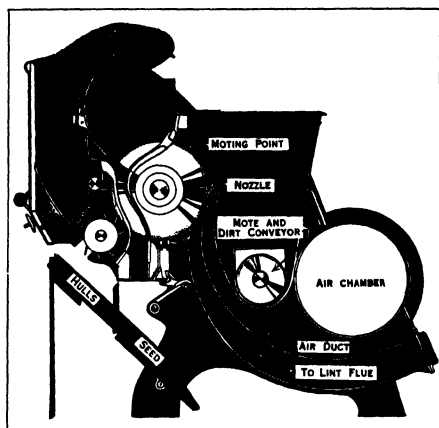
2, 3, COURTESY CHAMBER OF COMMERCE, GREENVILLE, S. C.; 1, 4, JAMES HUNTINGTON PHOTOS

SCENES IN A MODERN COTTON MILL

1. The weaving room with its scores of power looms.
2. Carded cotton being manufactured into yarn. The strands are gradually reduced in size by twisting.

3. A close-up view of a loom, showing cotton yarn in the process of being made into cloth. 4. The spinning room, where the fiber is made into yarn.

saws carry the seed cotton into the roll box where the teeth catch the fiber and pull it off the seed and between ginning ribs, allowing the seed to fall out. The lint is removed from the saws by a brush or blast of air and conveyed by air to the condenser, where



COURTESY MURRAY GIN CO.

CROSS SECTION OF AIR-BLAST COTTON GIN

it is dropped into the lint chute. The chute conveys it to the press box where it is tramped and pressed. See also COTTON MANUFACTURE.

COTTON GOODS INDUSTRY, UNITED STATES, the most important branch of American textile manufactures. Its development is based largely on the availability of low-cost water power or hydro-electric power, as in New England and the southeastern States, together with abundant supplies of raw materials and inexpensive labor. The industry embraces mills engaged primarily in the various processes preparatory to spinning, in spinning cotton yarn, and in weaving cotton or cotton-mixed goods.

COTTON GOODS MANUFACTURE, U.S.

Year	No. Estab- lishments	Wage Earners	Wages \$	Value of Products \$
1899	973	297,929	85,126,310	332,806,156
1909	1,208	371,182	129,789,717	615,217,702
1919	1,288	430,966	355,474,937	2,125,272,193
1929	1,281	424,916	324,289,094	1,524,177,087
LEADING STATES				
1929:				
N. C.	351	91,844	60,794,170	317,005,212
S. C.	159	71,731	46,758,560	241,435,659
Mass.	135	70,788	65,556,859	233,618,009
Ga.	137	55,868	35,346,064	212,851,829
Ala.	83	27,724	16,875,951	102,330,864
R. I.	55	21,833	21,778,173	86,203,795

COTTON-GRASS, the common name given to a genus (*Eriophorum*) of plants of the sedge family.

There are about 15 species, native to bogs and swampy places in north temperate regions, some 10 of which occur in the United States. They are rush-like plants, with slender, erect stems, grass-like leaves, and small flowers in terminal spikelets, which bear numerous long, silky, white or brown bristles, somewhat resembling tufts of cotton. A boreal species (*E. callithrix*) affords summer pasturage for reindeer in Alaska.

COTTON MANUFACTURE. Most cotton is picked by hand and separated from the seed by ginning. From 25 to 35% of the seed-pod or cotton boll is fiber, which is commonly known as cotton. A large part of the seed is the raw material for the cotton seed oil, feed and linter industry.

Cotton is classified according to its grade and staple, the standards being fixed in the United States by the Department of Agriculture. Short staple fibers are those below 0.98 in. long; medium staple, 0.98-1.17 ins.; long staple, 1.18-1.57 ins.; above 1.58 ins., they are extra. The value of cotton depends upon its length and quality. The longest and finest cotton in the United States is the Sea Island cotton which is rivaled by the Egyptian cotton.

Most of the machines used in manufacturing were invented from 100 to 150 years ago. The bale breakers take layers, four to six ins. thick, from the bales and tear them apart into small tufts. The action is continued through horizontal and vertical openers, which clean and open at the same time. This loose cotton is then passed to the pickers which continue the opening and cleaning. All these processes are used to separate the matted fibers and remove the heavy dirt. The product is delivered as a continuous sheet 40 in. wide called a "lay."

Carding is a method of brushing out the fibers, more completely opening the mass and continuing the cleaning to the removal of fine dirt and the undesirable short fibers. The product is delivered as a continuous rope, about one inch in diameter, called "sliver." For long staple cottons, combing is used to separate the long and short fibers. This is done by passing a series of very fine wire combs through the stock, held by a pair of jaws. When released, only the long fibers are drawn away, leaving the short fibers, called "noils," to be removed by the combs. For ordinary work, combing is omitted.

Drawing takes a number of card or comb slivers, combines and draws them out, thus making a more uniform sliver, having fibers more nearly parallel and straight. This operation may be used once or twice. The drawn sliver is reduced to the size suitable for spinning by from one to four roving operations, depending upon the fineness and quality of the yarn. This operation involves reducing the sliver to a smaller strand, using the necessary twist to give it the desired strength. Because the amount of draft is limited, several roving operations are required for the finer yarns.

Spinning is the operation which finally produces the "yarn" by further drawing and twisting to give

the desired strength. The strand cannot be further reduced because the twist binds it together so that it will break before attenuating.

Twisting takes two or more "single yarns" and makes a "ply yarn" of them.

Warping consists of winding many ends parallel to one another on a large double-headed spool, called a "beam." These ends are passed through a slasher, which combines the warps from several beams, coats them with a STARCH solution and then dries it on. The yarns are again wound on a beam and are ready as the warp for WEAVING. The warp gives the lengthwise threads of the cloth woven in the loom. The filling is the cross thread, which weaves over and under the warp threads, making a pattern, and binding them together.

The cloth from the loom is washed, bleached, dyed or printed to improve its appearance. See BLEACHING; DYEING and PRINTING. Often, it is singed, sheared, napped or starched to give the particular finish wanted.

Some mills produce yarns only, others unfinished woven fabric and still others finished fabric. Converters buy unfinished cloth and finish it themselves or at commission plants. The cotton yarn market carries an extensive line of single and ply yarns, carded or combed, twisted to suit the needs of the consumer and put up as cops, skeins, cones, tubes or warp beams. They may be gray, bleached, mercerized (see MERCERIZING) or dyed as desired. The cloth trade has a wide variety of fabrics, outstanding in which are print cloths and sheetings, constituting about 25% of the country's production.

The United States produces an average of around 14,000,000 bales of cotton of 500 lbs. gross weight, approximately half of which is exported. It requires 45,000,000 acres of land, which give an average yield of about 155 lbs. per acre, and 15,000 ginneries. The grade averages from strict low middling to middling. About half the crop is from 7/8 to 15/16 ins. long. The value of the cotton and seeds produced is about \$1,500,000,000 annually. The crude cotton seed products (by-products of the cotton fiber industry) are valued at about \$250,000,000 annually.

Manufacturing plants are located mostly in the Eastern states, from Maine to Florida, Massachusetts representing the center for the Northern states and the Carolinas for the Southern states. The manufacturing industry is distributed among about 2,000 mills, equipped with approximately 33,000,000 spinning spindles, 700,000 looms and the necessary preparatory machinery. At normal production, the industry employs about 500,000 workers and produces around 8,500,000,000 square yards of cloth annually from 7,000,000 bales. The value of the products manufactured annually is nearly \$1,600,000,000. The exports of cotton goods average around 600,000,000 square yards annually, having a value of about \$135,000,000. G. R. M.

COTTON PICKERS, machines for mechanically harvesting cotton. They can be divided into two

classes: those that strip both the cotton and the burrs from the plants used after a frost; those that pick only the cotton from the open burrs used any time during the harvesting season. Both types of machines have been perfected to the point where they will harvest on an average of 75 to 80% of the cotton.

COTTON SEED OIL. See OILS.

COTTON WHIGS, the conservative element in the WHIG PARTY which wished, as the CONSCIENCE WHIGS charged, to avoid the slavery issue in order not to injure the cotton trade by alienating the southern growers. The term was current in Massachusetts in 1848, in which year the party's presidential nominee, ZACHARY TAYLOR, and the platform were silent on the subject of slavery.

COTTONWOOD, the name given in the United States to several native species of poplar (*Populus*). The common or southern cottonwood (*P. deltoides* var. *virginiana*), known also as necklake poplar, grows in moist soils from Quebec to Florida and westward to North Dakota and Texas. It is a very large, rapidly growing tree, often planted for shade and ornament, sometimes 150 ft. high with a trunk 8 ft. in diameter. The flowers, borne in catkins before the broad, somewhat triangular leaves appear, are followed by long, necklace-like strings of pods containing a profusion of cottony seeds. This tree, which grew chiefly along streams, provided the early settlers in the interior prairie region with fuel, soft timber and quick shade. The smaller swamp cottonwood (*P. heterophylla*), of the southeastern states, with large leaves, 5 to 6 in. long and white-woolly when young, is valued for pulpwood. The black cottonwood (*P. trichocarpa*), found from Alaska to Lower California, sometimes growing 200 ft. high with a trunk 8 ft. in diameter, is the largest broad-leaved tree of the Pacific coast region of North America. The timber of the three foregoing species is utilized for softwood lumber and pulpwood.

In the Rocky Mountain region and in the arid southwest several smaller species of cottonwood occur, mainly along watercourses, and in deserts usually indicating the presence of underground streams.

COTTONY CUSHION SCALE (*Icerva purchasi*), an Australian insect (order Homoptera) accidentally introduced in California, where it formerly did great damage to orange, lemon and other citrus fruit trees. It has since been controlled by its predaceous enemy, an Australian species of ladybird beetle (*Vedalia*), purposely imported to destroy it. The scale-like female has an orange red body covered above by a white or yellowish powder, hence the popular name.

COTTRELL, FREDERICK GARDNER (1877-), American chemist, was born in Oakland, Calif., Jan. 10, 1877. He graduated at the University of California in 1896, continued scientific study in Europe, and in 1902 received the degree of doctor of philosophy from the University of Leipzig. In 1902-06 he was instructor, and in 1906-11 he was assistant professor of physical chemistry in the University of Cali-

tory output reached an approximate total of \$11,000,000; the retail trade amounted to \$17,445,067. The bluffs were an old Indian meeting place. In 1838 the United States established the site of the city as a settlement for the Pottawattamie Indians. The Mormons came and built a town called Kanesville, 1846-1851, but remained here only five years. During the gold rush the city was an outfitting station for prospectors. Council Bluffs was incorporated in 1853. Pop. 1920, 36,162; 1930, 42,048.

COUNCIL GROVE, a town in eastern Kansas, the county seat of Morris Co. It is situated on the Neosho River, 50 mi. southwest of Topeka, Kan., and served by bus lines and two railroads. Council Grove is a trade center for a grain-growing region. In 1825 a treaty was signed here with the Indians, giving the United States the right of way over the Santa Fé trail. In 1925 the town celebrated the one-hundredth anniversary of the trail. Monuments to the "Madonna of the Trail" and to the unknown Indians are features of Council Grove. Council Grove was incorporated in 1863. The city was the boyhood home of CHARLES CURTIS. Pop. 1920, 2,857; 1930, 2,898.

COUNTER-CURRENT FLOW. In technology it is often necessary to transfer heat or material from one fluid stream to another. Thus, it may be desired to cool a stream of water from, say, 200°F. to 80°F. There may be available another stream of water at 70°F., which is to be heated to 160°F. This can be done by passing one stream through a series of pipes in one direction and sending the other stream in the other direction through a jacket around the pipes. The flow is then counter-current. Heat is transferred between the two streams such that the leaving temperature of the cooler stream is nearly that of the entering temperature and considerably higher than the leaving temperature of the warm stream. *See also* PARALLEL FLOW.

COUNTERFEITING, the fraudulent and criminal imitation of money, including the altering of genuine coin so as to resemble or pass for coin of a higher denomination, and the like fraudulent altering of paper money. In the United States, as by the Constitution metallic money can be issued only by the federal government, and since the National Bank Act of 1864, only the federal government in effect can provide a paper currency, counterfeiting is subject to legislation by Congress and to the jurisdiction of the federal courts. But as counterfeiting money is a menace to the general security in the states as well as to the coin and currency of the government issuing the money, the several states have a concurrent jurisdiction to define and punish the offense. Hence it may happen that a counterfeiter may be prosecuted and convicted both by the federal government and a state government for the same act.

COUNTERPOINT, in music, the art of interweaving independent melodies into a harmonic whole. Counterpoint is divided into a variety of forms, which may be combined in the still more elaborate art of the FUGUE. Structurally, a composition in simple counter-

point begins with a principal theme, to which is then added another "voice," or instrument, starting on a different INTERVAL of the SCALE. To these two voices is joined a third one and presently to the three voices is added a fourth. Counterpoint may begin with the bass, tenor, alto or soprano "voice." In double-counterpoint, themes for these four voices are so devised that they may play or sing above or below one another; in other words, they are invertible. Eight melodies and even more are sometimes employed, so developed and kept moving that they do not conflict with, or double one another.

The rules governing the construction of counterpoint are derived from those of HARMONY, particularly those of concord and discord, stress being laid on the importance of contrapuntal melodies not obstructing each other's individual progress. The composition starts with a leading theme known as the *cantus firmus*. It is of a distinct character that may readily be recognized by the ear. Having made its announcement, it proceeds in a figured pattern of running passages up and down the scale, while the second voice starts, usually in the dominant key. The figuration in the first voice continues until the second one has reached its end of the repetition of the *cantus firmus*, and then branches off into still newer patterns, but which are composed out of bits of what has gone before. Meanwhile, the third voice has begun and after the fourth is fully entered, the composition goes into the sub-dominant key, or into the relative minor; the working-out portion (*durchfuhrung*) is then thoroughly developed from thematic material preceding. Short rest-periods for one or more of the voices, modulations, variations of the *cantus firmus*, give further contrast. The music comes to the "organ-point" with the bass holding out the low dominant note as the upper three voices resolve toward the end, and the composition comes to a more or less elaborate close, with the bass holding out the fundamental tone of the key in which the piece is written.

Although the ancient Greeks were known to have used a flute moving laterally with the voice, counterpoint, historically, first appeared in the 10th century in the crude form of two voices singing in parallel fourths or fifths. It rose to its highest peak with JOHANN SEBASTIAN BACH (1685-1750). T. St.

BIBLIOGRAPHY.—*Grove's Dictionary of Music and Musicians*, 1878-1927, S. Jadassohn, *Counterpoint*, 1898.

COUNTERPOISE, in radio, a network of CONDUCTORS used beneath an ANTENNA in place of the ground; it is insulated from the ground.

COUNTER REFORMATION. *See* REFORMATION, THE.

COUNTERSIGN, a word selected by the HEAD-QUARTERS of a command and communicated to certain officers and enlisted men of the guard to aid them in the identification of persons at night. It is given to individuals authorized to pass the guard lines at night and to members of the guard charged with passing or detaining persons appearing at the guard lines.

Unauthorized disclosure of the countersign is a serious military offense.

BIBLIOGRAPHY.—Winthrop's *Military Law and Precedents; Manual of Military Law*. The War Office, London.

COUNTERVAILING DUTIES are levied on imports into a country to offset either bounties granted by the exporting country or internal revenue taxes levied by the importing country on such home-produced goods. Properly a countervailing duty should be no higher than is necessary to place the home producer on an exactly equal basis with the foreign producer.

COUNTING MACHINE, a machine which enumerates the number of times an operation is executed. The simplest form comprises a series of drums with numbers from 0 to 9 so connected through a train of gears that one complete revolution of the right-hand drum is transmitted to those to the left of it according to the decimal system, the right hand drum being revolved by one digit each time a lever is actuated. The most recent development is the photoelectric counter which is operated by objects passing in front of it.

COUNT OF MONTE CRISTO, THE, a popular romance by DUMAS THE ELDER; published 1844. The exciting adventures of the young sailor, Edmond Dantes, begin when he is falsely imprisoned as a Bonapartist. In prison he has one friend, the Abbé Faria, who educates the youth, plots for his escape, and finally tells him of a buried treasure on the island of Monte Cristo. The thrilling escape is effected, and Edmond in due time gains possession of the treasure of Monte Cristo. Later, a dazzling figure, he appears in Paris and takes a cruel revenge on two old enemies, Danglars and M. de Villefort. He sails romantically out of sight, then, with the mysterious Greek girl, Haidee.

COUNTRY ROCK, in geology, the rock common in a given area. In mining, when reference is to ORE DEPOSITS, it means the rock in which the deposit occurs.

COUNTY, the principal administrative subdivision of the English kingdom, also known as shire. Local government under the Norman kings and their successors developed through the county in such offices as the sheriff, the coroner, the justices of the peace, etc. County administration was made uniform and representative in character by the Local Government Act of 1888.

In the southern American colonies the county, on an English model, was adopted, but in New England its place was largely taken by the Town. In the settlement of the West, new states have generally followed the county plan. Theoretically, the county is a mere subdivision of the state, for the local discharge of state administration, but under influence of American ideas, it has become largely autonomous and independent of state administrative control.

COUNTY CLERK, the clerk of the principal courts held in the County or the secretary to the county board (or both) who frequently has in addi-

tion important duties with regard to elections and in some states acts as county auditor.

BIBLIOGRAPHY.—J. A. Fairlie and C. M. Kneier, *County Government and Administration*, 1930.

COUNTY PARKS, centers of recreation and enjoyment, especially for the people of thickly settled urban districts. There is a growing demand for these parks and their number is steadily increasing, the greatest development having taken place since 1920. They are closely related to state park systems and supplement them in the same way that state parks supplement national parks. The first county parks were established in 1895 in Essex County and in 1902 in Hudson County in New Jersey. So far as is known, no other counties began definite park development before 1910 when Milwaukee County in Wisconsin purchased its first park area. In 1915 Cook and DuPage counties in Illinois began the establishment of their forest preserve and in the same year the first county parks were set aside in Michigan. In 1930 a total of 74 counties in 20 states had one or more parks with a total area of 108,485 acres. Michigan leads with 16 counties reporting parks; California is second with parks in 12 counties.

The parks vary from small areas, containing waterfront parks, playfield parks, golf courses, landscaped areas, and tourist camps, to large regions containing many of these features. Approximately three-fourths of the parks are over 500 acres in area. An outstanding example of county development is the Cook County Forest Preserve totaling 34,000 acres in 45 tracts and encircling the city of Chicago. It offers swimming, boating, bathing, tennis, golf, baseball, horseback riding, hiking, camping and all winter sports to the people of the city and vicinity and forms one of the greatest public playgrounds in the United States. Westchester County just north of New York City has an extensive system of five waterfront parks including the fully developed amusement park at Rye, New York, five inland reservations and eight parkways which occasionally widen into recreation parks. The 18 Westchester county properties cover a total of 17,000 acres. The majority of the California county parks feature both picnic and tourist facilities. Los Angeles county has 18 parks, including 6 in the mountains and 3 at the beach. Two of the mountain parks cover over 5,000 acres each. Michigan county parks are numerous but small.

COUP COUNTING, among the Indians of the Plains, particularly the Dakota, Blackfoot and Cheyenne, a well-defined and concrete system for the grading of deeds of valor, the details of which had many tribal variations. The term coup, meaning a blow or stroke, was adopted from the French Canadians. In a fight the first to touch or strike a fallen foe ranked higher than he who shot him down. Various ratings were given for touching an enemy, killing an enemy or taking a scalp. On ceremonial occasions the men achieving the distinction of having counted a coup announced their deeds and the methods of their accomplishment, thus acquiring a distinction in Plains

Indian social life. That all might recognize the possessor of the coup or coups, it was customary for him to record his prowess on his buffalo robe or the outer walls of his tipi. Some tribes also rewarded the owner of such coups with the privilege of wearing eagle feathers in the hair, which were specially decorated or notched, according to the particular significance of the deed commemorated.

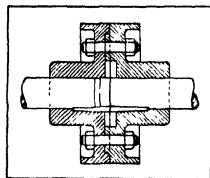
COUP D'ÉTAT, a French phrase which has come to stand for the overthrow of the constitutional government of a country by a dominant man, class, or party, and the seizing of power by the use of violence and in defiance of the constitution. The driving out of the Rump Parliament by Cromwell and the overthrow of the Assembly by Louis Napoleon are two outstanding examples of this means of gaining power.

COUPERIN, FRANÇOIS (1668-1733), French music composer, was born at Paris, Nov. 10, 1668. The most eminent member of a musical family, he was also the first famous composer for the harpsichord in musical history; to distinguish him from his uncle of the same name, whom he succeeded as organist at St. Gervais, Paris, he is known as François le Grand. SCARLATTI, BACH, and HANDEL were all influenced by his works. He died at Paris in 1773.

COUPERUS, LOUIS (1863-1923), Dutch poet and novelist, was born at The Hague, June 10, 1863. For 5 years after 1873, he lived in Batavia. He took up literature as his profession and became the editor of several literary journals between 1893-1903. In 1894 he wrote a volume entitled *Impressions of Travel*, and thereafter a series of oriental, fantastic and semi-historical novels that effectively established his reputation. Noteworthy among these are *Babel*, 1901, *Dionysius*, 1904, and *Light of the Mountain*, 1909, a story based on the life of the Emperor HELIOGABALUS. In his fiction Couperus shows a decided predilection for decadent men and times, delineated, however, in a naturalistic fashion with the delicate shades of the psychologist. A gentle irony and mockery adds a delightful atmosphere. Couperus died at Arnheim, Holland, July 16, 1923.

COUPLE. See TORQUE.

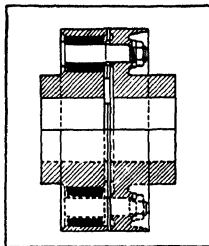
COUPLER, in railroading, a device for attaching cars to each other and to locomotives. The use of automatic couplers that eliminate the hazards to trainmen while coupling cars and increase the safety of operation by nearly eliminating slack in trains, has been compulsory in the U.S. since Jan. 1, 1898, when the Railway Safety Appliance Act took effect. See also DRAFT GEAR.



COURTESY LINK BELT CO
FLANGED FACE COUPLING

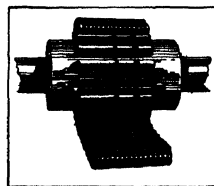
COUPLING, a mechanical connection between two lengths of shafting. Couplings may be either rigid or flexible. One of the oldest rigid types comprises two flanged collars keyed or clamped to the ends of the two shafts and bolted together. Another is the

jaw coupling, consisting of two collars having square or spiral projections which interlock. Flexible couplings are widely used, since they serve to absorb shock, and in some measure compensate for an imperfect alignment between the shafts that are connected. A commonly used flexible coupling is of the flange type with the connecting bolts set between rubber or spring bumpers. Another type comprises two hubs connected by steel rollers imbedded in a mixture of ground cork, hard grease and graphite. A somewhat different type consists of two coaxial sprockets connected by a silent chain. Another has rims with interlocking lugs between which a leather belt is interwoven to act as a shock absorber.



COURTESY LINK BELT CO
FLEXIBLE COUPLING
Cross-sectional view of coupling with connecting bolts set between rubber bumpers

The term coupling also applies to connections used to join sections of Hose. These are usually of the screw or hand instantaneous grip types, the latter being used for brake hose.



COURTESY MORSE CHAIN CO
FLEXIBLE COUPLING
Comprising two coaxial sprockets coupled together by a silent chain

For the type of coupling connecting vehicles, see COUPLER. **F. H. C. COUPLING, ELECTRICAL**, the relation between two or more electrical circuits which have one or more parts in common. Coupling may be accomplished either by a single INDUCTION COIL, condenser (see CONDENSER, ELECTRICAL) or CONDUCTOR, common to two circuits or by mutual induction between separate circuits.

COUPON, an interest certificate representing amounts of interest due on a certain date, attached to a bond and constituting a promise to pay in accordance with stipulations in the bond. Coupons are readily negotiable, being bearer instruments. The coupon usually states that the issuing corporation will pay on a certain date, a sum of money representing interest on the bond. As a bond is a promise to pay the principal of a certain debt, so is the coupon a promise to pay the interest.

COURANTE, an old French dance in triple meter, derived from *courir*, to run. The name was borrowed from a movement, usually the second, in the SUITE characterized by a lively tempo and many runs.

COURBET, GUSTAVE (1819-77), French realist painter, was born at Ornans, western France, June 10, 1819. He gave up theology to study art, in which he was largely self-taught. Courbet's aggressive nature, together with his choice of naturalistic subject-matter

and his use of harsh, unpleasant colors antagonized the critics. *The Stone Breakers* and the *Funeral at Ornans*, now in the Louvre, were unfavorably received at the Salon of 1850, and thereafter he exhibited independently. As the chief instigator of the overthrow of the Vendôme Column, May 16, 1871, Courbet was sentenced to 6 months' imprisonment and the costs of restoration. Upon his release he retired to Switzerland, where he died, at La-Tour-de-Peilitz, near Vevey, Dec. 31, 1877. Courbet was an uneven painter and a limited colorist. An intense but narrow realist, with his indifference to tradition and deliberate choice of ugly subject matter he sounded the death knell of ROMANTICISM and paved the way for EDOUARD MANET.

COURLAND. Conquered by the Teutonic Knights in 1245, Courland remained in their possession till 1561 when the order was dissolved and its Grand Master became Duke of Courland under Polish suzerainty. The Duchy remained independent, periodically disturbed by Russian and Swedish raids, till 1795. In that year the Courland Landtag, which was composed of nobles only, persuaded the Duke to turn the Duchy over to Russia, in return for a pension offered by Catharine II. Courland thus became a Russian province. While the use of the German language and the local institutions were to remain unchanged, absorption by Russia soon began. The Russian legal code was introduced in 1835, and in 1850 the use of Russian in public business was made obligatory. Serfdom was abolished in 1817. In 1905 an unsuccessful effort was made to establish a Lettish Republic. At the close of the World War, Courland became a part of the republic of Latvia.

COURT OF LAW, any duly constituted tribunal administering justice under the authority of the state or of the nation. The term court is also used of the place where justice is judicially administered. Originally the term court had reference to the courtyard of the King's house or palace where he sat to administer justice.

COURTRAI (Flemish, *Kortrijk*), capital of a district in the Belgian province of West Flanders, 2½ mi. from the French frontier, located on both banks of the navigable Lys. It is surrounded by old walls and has numerous churches, among them St. Martin's, dating from the 14th century, and Our Lady, completed in 1211. Also notable are the mortuary chapel of the old counts of Flanders and a painting of the Crucifixion by Van Dyck, also a fine Gothic city hall, 1417-1610, a belfry and the Stock Exchange. Courtrai is famous for its linen and laces, and has large bleaching and dyeing plants. The ancient town of Cortoriacum, it is famous for the victory in 1302 of the weavers over the patricians and their French allies. Pop. 1930, 38,560.

COURTRAI, BATTLE OF, a historic engagement between the Flemings and the French, which occurred on July 11, 1302, near the Belgian town of Courtrai, and resulted in a French defeat. The conflict was precipitated by injustices inflicted by James de Châtillon, French governor of Flanders, on the con-

quered Flemings. The latter rebelled and, led by Guy, count of Flanders, prepared to resist a French punitive expedition led by Robert of Artois. The French knights, so confident of victory that no reconnaissance was deemed necessary, charged boldly, and when stopped at the canal were easily unhorsed by the Flemish pikemen. Two flanking parties completed the defeat of the French, who were said to have lost 200 nobles and 6,000 soldiers. The victors gathered from the battlefield 700 pairs of gold spurs from the bodies of the French; accordingly the action is sometimes known as the Battle of Spurs.

COUSENS, JOHN ALBERT (1874-), American educator, was born in Brookline, Mass., Nov. 17, 1874, and graduated in 1898 at Tufts College. He was prominent in business and civic affairs of Brookline, where he became president of the Brookline Savings Bank, director of the Brookline Trust Company, a member of the United States Chamber of Commerce, and officer and member of many societies for the advancement of education. In 1919 he was elected president of Tufts College, of which he was one of the trustees.

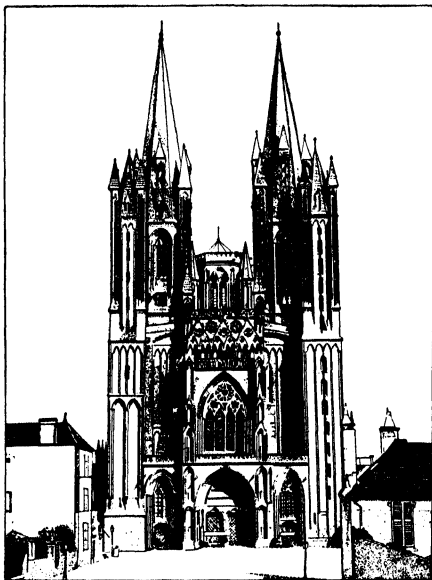
COUSIN, VICTOR (1792-1867), French philosopher, was born in Paris, Nov. 28, 1792. In 1815 he became a professor at the Sorbonne, and from 1830-51 was director of the École Normale Supérieure. As Minister of Public Instruction he exerted much influence on education, issued a celebrated report and organized the French school system. His philosophy was an eclecticism that exerted considerable influence in its day. Among his writings are: *Fragments of Philosophy*, 1826, *The True, the Beautiful, and the Good*, 1837, and *Elements of Psychology*, 1856. Cousin died in Paris, Jan. 13, 1867.

COUSIN MICHAEL, a nickname for the Germans, comparable to UNCLE SAM as applied to Americans and JOHN BULL to the British. It is probably derived from the Old German "Michel," meaning gross, slow and heavy.

COUTANCES, an old town in the Department of Manche, Normandy, France, on the River Soule, 58 mi. south of Cherbourg; noted for its Gothic cathedral. Notre Dame of Coutances was built mainly in the early 13th century, replacing an 11th-century structure of which only the bases of the western towers remain. The west front is particularly fine, with typically Norman towers crowned by stone spires. The central tower, which forms a lantern at the crossing of nave and transepts, is notable for its bold but harmonious design. The interior as a whole is a good example of the pure French Gothic of the early 13th century. Henry Adams has pointed out in the architecture of the Coutances choir another suggestion of the Cathedral of Chartres.

The church of St. Pierre is an interesting structure dating from about 1500. The town has also a charming public garden of 17th-century design. Coutances derives its name from its fortification in the 3rd century by Constantius Chlorus. Like many of the towns in this district, it suffered from Norman

invasions and from the English wars. It was held by the English for 32 years in the 15th century, and was four times captured by the Huguenots during the religious wars of the following century. The town lies in a countryside which produces much live



WEST FAÇADE OF THE CATHEDRAL OF COUTANCES

stock, and its principal industry is the export of cattle. It holds two great fairs each year. Pop. 1931, 5,691.

COUTHON, GEORGES (1755-94), French revolutionist, was born at Orect, Dec. 22, 1755. He was educated as a lawyer, and practiced at Clermont. Elected a member of the legislature, and then to the national convention in 1792, he voted for the death of the king, later joining ROBESPIERRE. Couthon has been accused of participating in the cruelties at Lyons, but Collot d'Herbois is often considered as the instigator of the massacre. After the Lyons affair, Couthon returned to Paris, became more closely associated with Robespierre and Saint Just, in their activities, which reached such excesses that they were finally overthrown. Couthon was guillotined in Paris, July 28, 1794.

COUVADE, a custom related to childbirth, practised by primitive peoples. Among the Brazilian Indians, when a couple has issue the wife resumes her work immediately after childbirth, while the husband lies in his hammock and observes a system of religious fasting. This change in the rôles of the parents is supposed to benefit the child. The custom was also current about 1830 among the Basques of the Pyrenees.

COUZENS, JAMES (1872-), American public official, was born at Chatham, Ont., Aug. 26, 1872. He had a public school education and when twenty-one went to Detroit, Mich., where in 1903 he entered the automobile manufacturing business, and later held various responsible offices in the Ford Motor Co. In 1919 he was elected mayor of Detroit and served until 1922 when he was appointed U.S. Senator to finish the term of Truman H. Newberry. He was returned to the Senate in 1923, and reelected in 1930.

COVENANTERS. Scots who rebelled against the religious policy of the Restoration period and later refused to accept the settlement effected by the revolution of 1689 which reestablished Presbyterianism but did not renew the covenants. These covenants were agreements entered into, especially in 1581 and 1638, for the defence of the reformed faith (Calvinism) and the liberties of the kingdom.

COVENT GARDEN, a square in London, England, noted for its theater and for its fruit, flower and vegetable markets. The square was laid out by INIGO JONES in 1632 and takes its name from having once been occupied by the kitchen garden—the Convent garden—of Westminster Abbey. The market early established there now covers about three acres of the extended square, and consists chiefly of a market house, built in 1831, and a flower market, 1859. Covent Garden Theatre, built originally by John Rich in 1731, was twice destroyed by fire and rebuilt in 1808 and again in 1856.

COVENTRY, a city of Warwickshire, England, situated on the Sherbourne, an affluent of the Avon, 94 mi. northwest of London. Coventry possesses two interesting ancient structures in the Gothic St. Michael's Church (1230-1305) and St. Mary's Hall, erected in the 14th century. The latter is one of the most ornamental buildings in England, with carved oak roof, beautiful tapestry and a large stained glass window. The widespread use of the cycle, motor-cycle and motor car in recent years has led Coventry to substitute such industries for silk-ribbon weaving. Pop. 1921, 146,108; 1931, 167,046.

The expression "put in Coventry," meaning to refrain from associating with or to ostracize a person, is said to have come from the fact that royalist supporters of Charles I were captured and imprisoned there.

COVENTRY, a town of central Rhode Island in Kent Co. It is situated on the Flat River about 55 mi. southwest of Providence. The New York, New Haven and Hartford Railroad and bus lines afford transportation. Manufacturing is the principal industry, with woollens and cotton goods the most important products. Pop. 1920, 5,670; 1930, 6,430.

COVER, a term meaning the repurchase of Stock that has been previously sold **SHORT**. One who is short of a stock is said to cover when the price has fallen to a point where he may fulfill his contract to deliver and at the same time make an expected profit. Rising prices sometimes force shorts to cover in an active market. See **SHORT SELLING**.

COVERDALE, MILES (1488-1568), first translator of the whole Bible into English, was born in the North Riding of Yorkshire, England, in 1488. After studying at Cambridge, he was ordained at Norwich in 1514, and joined the Augustinians. In 1535 his translation of the *Bible* from the Dutch and Latin was published, probably at Zurich. Three years later he supervised the issue of *The Great Bible*, and in 1640 edited *Cranmer's Bible*. After the death of Thomas Cromwell, Coverdale lived on the Continent, but returned to England in 1551, upon his appointment as Bishop of Exeter. During Mary's reign he resided in Denmark. Returning to London in 1558, he died in Feb. 1568.

COVERLEY, SIR ROGER DE, a country knight who figures in 30 papers of Addison's *Spectator*. He is represented as the type of amiable, delightful, slightly eccentric country gentleman of the times of Queen Anne.

COVINGTON, a city of northern Kentucky, and one of the county seats of Kenton Co., situated on the Ohio River opposite Cincinnati, O., and on the Licking River opposite Newport, Ky. The Chesapeake and Ohio, the Louisville and Nashville and the Cincinnati Southern railroads serve the city. The surrounding region is largely given over to truck gardening. Among the manufactures are X-ray machines, iron fences and machinery. In 1929 the industrial output reached about \$18,000,000; the retail trade amounted to \$25,780,371. The settlement, founded in 1812, was named for Gen. Leonard Covington. In 1834 Covington received a city charter and in 1908 annexed Central Covington. Pop. 1920, 57,121; 1930, 65,252.

COVINGTON, a city and the county seat of Allegheny Co., in western Virginia, picturesquely situated in the Allegheny Mountains, and on the Jackson River, 60 mi. northwest of Roanoke. It is served by the Chesapeake and Ohio Railroad. Iron and coal are found in this region, also vast areas of lumber. The city's industrial plants include silk, rayon and pulp and paper mills. There are several mineral springs and fashionable watering resorts in this region. The city was founded in 1822 and incorporated in 1842. Pop. 1920, 5,623; 1930, 6,538.

COWBANE, a name given to various species of *WATER HEMLOCK* (*Cicuta*), the foliage and fleshy rootstocks of which are very poisonous to cattle.

COWBIRD, one of a small group (*Molothrus*) of New World birds of the blackbird family (*Icteridae*). The male of the common species of the United States (*M. ater*) is about 8 in. long, has glossy black plumage except for its brown head, neck and chest; the slightly smaller female is brownish-gray. This cowbird is found from New Brunswick to Mackenzie and southward throughout the United States to central Mexico, breeding as far south as Texas. Associating in small flocks, it frequents pastures and woodlands, and is often seen about cattle, feeding at their feet or perching on their backs. Its food consists chiefly of insects, weed seeds and occasionally grain. Like the

European cuckoo the cowbird builds no nest of its own but deposits its speckled, whitish eggs in the nests of numerous other birds smaller than itself, especially in those of the woodpeckers, flycatchers, sparrows, vireos, and warblers, leaving the task of hatching and nourishing the young entirely to the foster parents.

COWCATCHER or **PILOT**, a device used at the front end of American LOCOMOTIVES. It is wedge-shaped both horizontally and vertically so as to throw animals or other objects which are struck upward and outward from the track.

COWICHAN, a large group of American Indian tribes speaking a single Salish dialect and occupying the valley of the Fraser River to Spuzzum, Brit. Col., and the southeastern coast of Vancouver Island between Nonoos Bay and Sancti Inlet.

COWL (medieval Latin *caputium*), a hood which envelops the entire head except the face, and also covers the shoulders. It is pointed behind and in front is buttoned under the chin. Shortly after the time of St. Benedict, the cowl was sewed on the tunic, from which resulted the characteristic garb of the monks. The Capuchin Order, a branch of the Franciscans, derives its name from the *caputium*.

COWL, a cap or hood placed on the upper end of a pipe extending through the roof of a building to utilize the wind action to create a draft (see DRAFT) in the pipe. Cows may be classified as stationary or rotary. Either type may use the induction or ejector principle. The main action of a cowl is due to the low pressure area on the leeward side into which the gases from the pipe are discharged. The cowl must provide smooth, easy air passages with sufficient discharge area. If the cowl is of the ejector type, additional outlet area must be provided to take care of the siphoning air.

Also applied to the projection of an automobile engine hood back over a portion of the driver's compartment, serving the same purpose, in some cases, as described above.

COWLES, HENRY CHANDLER (1869-), American ecologist, was born in Kensington, Conn., Feb. 7, 1869. Graduating from Oberlin College in 1893, he was professor of natural sciences at Gates College, Nebraska, in 1894 and 1895 and from 1895 to 1897 fellow in geology and botany at the University of Chicago. He was special field assistant on the U.S. Geological Survey, and from 1902 to 1907 was instructor in botany at the University of Chicago, becoming assistant professor there in 1907 and professor eight years later. Cowles was one of the founders of the modern practice of ecology; particularly important was his study of the dunes on Lake Michigan and his book *Vegetation of the Sand Dunes of Lake Michigan*, 1899. He was likewise the author of *Plant Societies of Chicago*, 1901; *Text-book of Plant Ecology*, 1911; and *Plant Societies of Chicago and Vicinity*, 1913.

COWLEY, ABRAHAM (1618-67), English essayist and poet, was born in London in 1618. While

still a school-boy he published his first collection of verses, *Poetical Blossoms*, containing his *Tragicall History of Piramus and Thisbe*, one of the most remarkable examples of imaginative precocity in the history of literature. In 1637 he was elected to a scholarship at Trinity College, Cambridge. There he published his pastoral comedy, *Love's Riddle*, his *Nauffragium Jocular*, and had his comedy, *The Guardian*, enacted before Prince Charles, later Charles II. His epic *Dauides*, a life of David in rhymed heroic verse, was never completed. Ejected from Cambridge because of his Royalist sympathies, he went to Oxford where he published his satirical poem, *The Puritan and the Papist*. He followed the queen in her flight to Paris and remained 12 years, working actively in the Royalist cause. He returned to England with the Restoration, and settled down on a farm at Chertsey to write and to enjoy the popularity that the collected edition of his poetry in 1656 brought him. *The Mistress* was the great popular success of the time, though to-day it is seldom read. He died July 28, 1667, and was buried in Westminster Abbey.

BIBLIOGRAPHY.—*Poems of Abraham Cowley*, ed. by A. R. Waller, 1905; A. H. Nethercote, *Abraham Cowley*, 1931.

COWLITZ, a once numerous Salish-speaking Indian tribe formerly living on the Cowlitz River in southwestern Washington. They are now segregated with the Chehalis, living with them on a reservation of the same name.

COW-PARSNIP, the common name given to a genus (*Heracleum*) of coarse perennial herbs of the parsley family. There are about 60 species, found

In Alaska the leaf-stalks are peeled and eaten like celery.

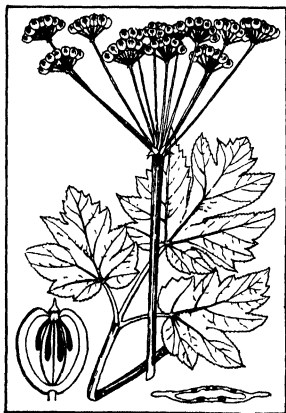
COWPEA (*Vigna sinensis*), an annual of the pea family, native probably to Asia and cultivated since remotely ancient times. It is extensively grown as a fodder crop and green manure in the southern states, where it plays a role as important as red clover in the North or alfalfa in the West. The seeds, borne in long pods, are sparingly used for human food.

COWPENS, a national monument at Cowpens, South Carolina, commemorating the battle of the Revolutionary War which was fought in the locality, on Jan. 17, 1781. The monument, which has an area of one acre, was established Mar. 4, 1929 under the administration of the War Department. It is reached by the Southern Railroad.

COWPENS, BATTLE OF, Jan. 17, 1781, a battle of the REVOLUTIONARY WAR, which resulted in a major victory for the American army. In a cattle-grazing district of South Carolina, The Cowpens, Lieut.-Col. Tarleton with 1,100 British troops attacked a somewhat smaller American force under Gen. Morgan. After rebuffing three assaults, Morgan's line retreated. In jubilation, the British broke ranks. Morgan's men faced about, charged with bayonets, and while a troop of Maryland cavalry repulsed the British horse, put the British infantry to rout. The Americans lost 72 killed and wounded; the British over 300 killed and wounded, and 500 captured. Cannon, guns and horses were abandoned in the flight. The news of this engagement checked Cornwallis's endeavors to enlist the Tories of Virginia and the Carolinas in the British army.

COWPER, WILLIAM (1731-1800), English poet, was born Nov. 26, 1731. He came of a family that boasted Plantagenet blood. Cowper lost his mother at six, and the sensitive child was sent to school, where he suffered from boyhood tyranny. At 21, he "took chambers," but gave law no serious attention. At this time he began to show signs of his life-long mental derangement, and attempted suicide rather than appear at a public examination. After about 18 months he recovered and at Olney, with the Rev. John Newton, wrote the *Olney Hymns*. Sympathetic friends, the Unwins, and Lady Austen, who urged him to write of John Gilpin, brightened his life. Cowper was more than 50 when his first book, *Poems*, 1779, appeared. This won little praise, but *The Task*, 1785, was immediately successful. Among other works were *The Tirocinium*, 1784, *Translation of Homer*, 1791, a revision, 1802, and *Letters*, which rank with the best in English. Cowper extended the range of English poetry to subjects formerly considered outside it, and throwing aside the cold constraint of the 18th century, to write unhesitatingly as he felt, he was the herald of a new humanity in literature. On the death of Mrs. Unwin in 1796, his mind was again clouded, and he died Apr. 25, 1800. See also ENGLISH LITERATURE.

COWPOX, a contagious disease of cattle, the first symptom of which is a slight fever followed by a



FROM JEPSON. MAN. FL. PLANTS CALIF. COPYRIGHT

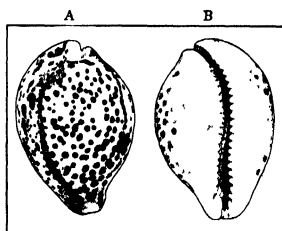
WOOLLY COW-PARSNIP

Flower cluster, leaf, carpel and section of the carpel

chiefly in north temperate regions, several of which are grown for their foliage. The woolly cow-parsnip (*H. lanatum*) occurs widely in North America. It is a tall stout perennial, with grooved stems, large divided leaves, and broad clusters of white flowers.

lessened milk flow and the characteristic eruptions or "pox" on the teats. This eruption forms small red nodules which increase in diameter until they are an inch across on the eighth or tenth day. At this time the contents have become fluid—clear at first—then changing to pus. This dries up leaving a dark crust over the wound which gradually heals. Treatment consists of washing the wounds with antiseptic solutions. See also VACCINATION.

COWRY, the common name for a gastropod mollusk of the family *Cypræidae* of sea snails. There are over 150 species of cowry, found chiefly in warm shallow water along the coast of Asia and Africa. Cowries are well known for the beauty of their



COURTESY AMER. MUS. OF NATL. HISTORY

TIGER COWRY (*Cypraea tigris*)

A, Dorsal surface B, Ventral surface

shells. In the young cowry the shell has the spiral form typical of the snails, but as the animal grows older this form is gradually lost. In the adult the shell is inrolled and beautifully shaped and its original spiral is almost completely hidden. Cowry shells show a great variety of charming patterns and colors. When the animal is alive its mantle, which has branched appendages, turns back, and its folds often nearly cover the shell.

The shell of the money cowry (*Cypraea moneta*) has served as coin among many primitive peoples in Africa and Asia. Cowry shells are also used as ornaments, and in parts of the South Seas the beautiful shell of the orange cowry (*Cypraea aurantium*) may be worn only by princes and chieftains.

COWSLIP, a name widely given to the common primrose (*Primula veris*) of Great Britain, many forms of which are in cultivation. The name is applied also to various other plants including the marsh marigold (*Caltha palustris*) and the shooting star (*Dodecatheon* sp.). The bluebells (*Mertensia virginica*), found widely in eastern North America, is also known as Virginia cowslip.

COW-TREE (*Brosimum Galactodendron*), a South American tree of the mulberry family, common in Venezuela, where it sometimes forms large forests. It often grows 100 ft. high, with a smooth trunk, 6 to 8 ft. in diameter, rising unbranched for 60 to 70 ft. and bearing large, shining, leathery leaves. A wholesome nourishing juice, much resembling cow's milk and extensively used as food by the natives, is obtained by making incisions into the trunk.

COX, JAMES MIDDLETON (1870-), American publisher and public official, was born near Jacksonburg, Ohio, March 31, 1870. After receiving a high school education, he entered the field of journalism, and between 1898 and 1923 became owner of newspapers in Dayton, Springfield and Canton, Ohio, and in Miami, Fla. He was a member of Congress 1909-13, and governor of Ohio in 1913-15 and 1917-21. As governor he effected many reforms, including the establishment of a state budget system, and various workmen's compensation and minimum wage laws. In 1920 he was Democratic candidate for President, but was defeated by Harding. In his campaign he advocated immediate ratification of the Versailles Treaty without reservations, and entrance of the United States into the League of Nations.

COX, KENYON (1856-1919), American painter, was born at Warren, O., Oct. 27, 1856. He studied in Cincinnati and Philadelphia, and in Paris in 1877-82 under Carolus-Duran and Gérôme. Returning to New York, he specialized in portraits and figure pieces, taught in the Art Students' League and wrote on art subjects. In 1903 he became a member of the National Academy. Cox painted two decorations in the Library of Congress, Washington; one in the Walker Art Gallery, Bowdoin College; one in the Minnesota State Capitol, and a frieze in the Appellate Court Building, New York City. Among his publications are *Painters and Sculptors*, published 1907, and *Concerning Painting*, 1917. Cox died in New York City, Mar. 17, 1919.

COXEY'S ARMY, the best-known of several "armies of the unemployed" which in 1894 marched to Washington, D.C., to demand relief legislation of Congress and the Executive. Larger armies were those led by Charles T. Kelly, from San Francisco, and Lewis C. Fry, from Los Angeles. Widespread unemployment following the Panic of 1893 gave rise to industrial armies organized independently in various cities and to various schemes of relief legislation, one of which, sponsored by Jacob S. Coxey, combined the issuance of legal-tender notes with a program of good-roads construction. Coxey, a successful business man and farmer of Massillon, O., met at a Populist convention in 1893 Carl Browne, labor agitator and politician of California. Browne proposed a march of unemployed men to Washington as a "living petition" for Coxey's relief program. On Easter Sunday, 1894, with a scant 100 men, Coxey's Army started from Massillon, gathering additions as it marched. At Homestead, Pa., the army numbered 600 men, its largest figure. From Cumberland to Georgetown the army traveled by barge on the Chesapeake and Ohio Canal, the only part of the distance not traversed afoot. On May 1, joined by a contingent of unemployed men from Philadelphia led by Christopher Columbus Jones, Coxey's Army marched down Pennsylvania Avenue amidst the sympathetic cheers of 20,000 spectators to the national capitol. Here the leaders and crowd were rushed and manhandled by

overzealous police, over 50 spectators being injured. Coxe and two others were sentenced to prison for 20 days for violation of the Capitol Grounds Act. Two encampments of the marchers, at Bladensburg and Rosslyn, were maintained until summer, by which time the futility of the appeal was evident.

COYOTE, the North American prairie-wolf (*Canis latrans*), inhabiting the western plains and mountains as far south as Mexico. Smaller than the other wolves, it is about the size of a setter dog, with bushy tail and long, thick fur. The color, varying with the seasons and locality, is prevailing yellowish gray overlaid with a black that deepens along the back. Coyotes dig burrows for themselves, or occupy burrows made by badgers and prairie-dogs. They acquired the early name of barking-wolf from their strange cry, a mingled bark, yelp and long-drawn wail that seems to issue from more than one throat. Mice, gophers, prairie dogs, hares, game-birds, young of big game animals and lambs constitute their chief food. Not so fleet and more timorous than other wolves, they never attack man and seldom a large adult animal, but winter famines drive them in packs to fall upon sheep-folds or cattle ranches. When animal food is unobtainable, they fall back on juniper berries, hips and prickly pears. Despite the advance of civilization, they increase rather than decrease in number in isolated regions, owing to their cautiousness and adaptability to varying conditions. In May or June the female produces from 3 to 10 young. Coyotes are docile in captivity.

COYOTE BRUSH (*Baccharis pulularis*), a shrub of the composite family, known also as chaparral broom, common on mountain slopes and coastal sand dunes from California to Oregon. It grows 2 to 5 ft. high, with angular branchlets and broad, blunt, usually toothed leaves about an inch long. The small whitish or yellowish flower-heads are borne in clusters along the leafy branchlets.

COYOTERO, a sub-group of the Apache, speaking a dialect of the Athapaskan stock. The Coyotero are subdivided into two groups, the Pinal Coyoteros and the White Mountain Coyoteros. They roamed over Arizona and western New Mexico, but claimed the western part of the present White Mountain Reservation between San Carlos Creek and Gila River as their territory. They were true nomads, living on the products of their desert environment.

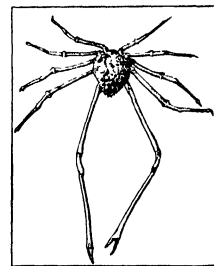
COYOTILLO (*Karwinskia Humboldtiana*), a shrub or small tree of the buckthorn family, native from western Texas and Lower California southward to Yucatan. It grows from 3 to 25 ft. high, with a trunk sometimes 8 in. in diameter, bearing oval leaves, small flowers in axillary clusters, and sweet, edible, blackish fruit. The stony seeds, however, are highly poisonous, especially to children and domestic animals, causing paralysis of the limbs.

COYPU (*Myopotamus coypus*), a large aquatic South American rodent, whose brown fur is used and known commercially by the Spanish name of nutria. It occurs on both sides of the Andes, living

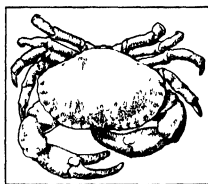
in pairs in burrows and feeding on aquatic plants. A coypu may attain a length of 2½ ft., exclusive of the round, naked tail, which is nearly as long as the body. The head is depressed, the ears are small, and the limbs short. The webbed hind feet enable the coypu to swim with ease, and the female while in the water carries her young safe and dry on her back. Her teats are far up on the side of the body. The coypu is hunted for its flesh as well as for its fur.

CRAB, the popular name for members of a section (*Brachyura*) of crustaceans, and also for some of their near relations, particularly the HERMIT CRABS. There are many families, found on almost every seashore; some species, as adults, live far inland; others are found in fresh water, and the majority frequent beaches or shallow salt water. Only a few forms ever venture far out to sea.

True crabs are usually more or less triangular or oval in shape. They have very small abdomens, that look like tails and are carried curled up under their bodies. Like most crustaceans they wear horny armor, which must be shed or moulted periodically, because after it has hardened it does not grow with the animal. Their eyes are borne on stalks, and can be turned in any direction, or pulled down into sockets. A large pair of claws, which might better be called arms than legs, since they are used to seize prey and grasp enemies, are placed near the head region. Behind these are four pairs of walking legs. If a crab's leg is caught under a stone, or in the grasp of an enemy, he can shed it, and grow a new one in its place. In some species one pair, or all the walking legs are transformed into swimming paddles. Crabs range in size from forms a fraction of an inch across to the Japanese giant crab, whose claws may span 11 feet, and there are species of every color, including black and white. They are commonly omnivorous feeders.



JAPANESE SPIDER CRAB



EUROPEAN EDIBLE CRAB

The female lays hundreds of eggs, which she carries under her folded abdomen. When they hatch the babies are liberated in the water. Even land crabs journey to the sea to deposit their young. A baby crab is usually a larva (*zoea*) quite unlike the adult when it hatches, and during its early life it swims at the surface of the sea.

Many kinds of crabs are good to eat. In the United States the blue crab (*Callinectes sapidus*), found on the Atlantic coast, and in the Gulf of Mexico, is the most important edible species.

A. I. W.

In 1929 the commercial catch of crabs in United States waters amounted to 82,089,000 lbs. with a value of \$2,225,000; this total included blue or hard crabs, 70,781,000 lbs. valued at \$1,664,000. See also FIDDLER CRAB; HERMIT CRAB.

CRAB APPLE, a group of several species of the genus *Pyrus*, family *Rosaceae*, closely related to the apple and scarcely distinguishable except by the pre-eminently smaller and more acid fruits. Crab apples are bushy shrubs or small trees with widely spreading branches, sometimes thorny, natives of temperate North America and Asia. The American crab, *Pyrus coronaria*, is an ornamental native tree. *P. baccata*, of northeastern Asia, and *P. prunifolia*, probably a hybrid but perhaps of Chinese origin, are cultivated as Siberian crab; their fruits are used for jelly and preserves. Several other Asiatic species with small inedible fruits have been introduced into cultivation for their flowers, which are white, pink, or red, handsome, and produced in quantity. Among the more popular are Hall crab (*P. Halliana*), and its variety Parkman crab, Sargent crab (*P. Sargentii*), and Showy crab (*P. pulcherrima*). Several hybrid crabs are known, including one between the crab and the apple. H. A. G.

CRABBE, GEORGE (1754-1832), English poet, was born at Aldeburgh, Suffolk, Dec. 24, 1754. He had little formal education, but was apprenticed to a surgeon, and practiced in Aldeburgh. Failing to make a living he went to London in 1780. Burke rescued him from dire poverty, enabling him to publish his *Library*, and enter the church. He held various livings but continued writing. Though admired by critics, Crabbe missed popularity. His *Tales of the Hall*, 1817, included his former works. As a realist he was a forerunner of THOMAS HARDY. He died at Trowbridge, Feb. 3, 1832.

CRAB GRASS (*Digitaria sanguinalis*), a decumbent or prostrate annual closely allied to the panicums, called also finger grass. It is a native of the Old World widely naturalized in tropical America and also in cultivated soil throughout the southern and eastern United States and in California. The stems, often rooting at the lower joints, bear flat, somewhat hairy leaves and several very narrow flowering spikes in a digitate whorl terminating the stem. Crab grass is sparingly utilized for forage and sometimes cut for hay.

CRABTREE, CHARLOTTE ("LOTTA") (1847-1924), American actress, was born at New York, Nov. 7, 1847. At the age of nine she sang in public resorts in California settlements and was popular with the miners who paid her by tossing gold nuggets on the stage. She first achieved success in 1867 at Wallack's Theatre in New York, in *Little Nell and the Marchioness*, her most ambitious play. This was followed by successful seasons at Niblo's, The Olympic and Booth's Theatre. For 20 years she was an immense favorite with American audiences, particularly in the West, where she was idolized. Following a serious accident, she retired

from the stage in 1890. Her fortune of nearly \$4,000,000 was the subject of considerable litigation after her death. She died in Boston, Sept. 25, 1924.

CRACKING PROCESSES, those processes which utilize the pyrogenic, or heat producing, decomposition of PETROLEUM for the conversion of heavier oils into lighter products, particularly GASOLINE.

In the principal modern liquid phase processes (see PHASE RULE) the oil is heated in a "tube" still, or furnace, to 800°-1200°F. under pressures of 350-1000 lbs. per square inch. From the furnace the oil flows to a "reaction" vessel, usually maintained under pressure and in some processes heated. The liquid from the reaction vessel passes to a "flash" chamber, maintained under lower pressures, from which the residuum is drawn off. Some processes employ the reaction vessel alone or the flash chamber alone. The vapors from the reaction vessel and flash chamber enter a FRACTIONATION tower where the crude gasoline fraction is separated from the unconverted oil. The latter is then returned to the furnace with the fresh charge. Ultimate conversion of the charging stock into gasoline varies from 40 to 75 per cent.

The principal liquid phase cracking processes and their daily charging capacities in barrels on Jan. 1, 1931, were: Tube and Tank, 385,460; Dubbs, 252,250; Cross, 245,800; Holmes-Manley, 233,900; Isom, 179,150; Burton, 164,249. These processes comprised 75% of the cracking plant capacity of the United States.

Vapor-phase processes differ from liquid-phase processes principally in lower pressures and higher temperatures of operation, although newer liquid phase processes are approaching the temperatures employed by vapor-phase processes. The principal vapor phase processes and their capacities in barrels are: Gyro, 16,000, and de Florez, 13,550.

In 1925, 24% of the gasoline produced in the United States was provided by cracking; in 1930, 37.7 per cent. M. So.

BIBLIOGRAPHY.—H. S. Bell, *American Petroleum Refining*, 1930.

CRACOW or **KRAKOW**, capital of the Polish voivodeship of the same name, situated on the left bank of the Vistula River in a valley surrounded by the Jura Krakowska Mountains. In the 10th century it was already a remarkable town and the residence of the bishops. In the 11th century Boleslas the Bold transferred the capital of Poland from POSEN to Cracow. From the beginning of the 14th century to the time of the partition of Poland Cracow was the place of the coronation of the Polish kings. (See POLAND, HISTORY OF.) The city has a lofty castle, old churches and fine parked promenades circling the inner city, whose finest square surrounds the Cloth Hall of the 13th century. The castle, where the Polish kings lived before 1610, is on a hill. Adjoining it is the cathedral, the most noteworthy of the many churches, which was built from 1320 to 1364 to take the place of one built in 1110, the burial place of the Polish kings. The Church of St. Mary founded about 1225 and the Dominican Church of the 13th

century are also of interest. The Jagellonian University founded in 1364 is one of the oldest of the universities of central Europe.

No other town in Poland can be compared with Cracow in the wealth and variety of its monuments. The city reached its greatest splendor during the time of the Jagiello dynasty 1386-1572. Cracow, being the residence of the rulers of united Poland and Lithuania, was safe from the invasion of enemies, and became one of the largest and most beautiful European towns of that time. The decline of the city began about 1600, when, after a fire in the Castle of Wawel, which partly destroyed it, Sigismund III transferred the capital of Poland to Warsaw. After the third partition of Poland Cracow belonged to Austria. In the period from 1815-46 it formed an independent republic, but was later again occupied by the Austrians. There are a number of factories producing machines, leather, chemicals, tobacco, furniture and metal goods. Trade is chiefly in agricultural products, grain and cattle. Pop. 1931, 221,260.

CRADDOCK, CHARLES EGBERT. See MURFREE, MARY NOAILLES.

CRAFTON, a borough in southwestern Pennsylvania, in Allegheny Co., situated 6 mi. west of Pittsburgh; served by the Pennsylvania Railroad. It is an independent branch of the Pittsburgh Post Office. Crafton is strictly residential, there being no industries of any kind. Pop. 1920, 5,954; 1930, 7,004.

CRAIG, EDWARD GORDON (1872-), English stage designer and author, son of ELLEN TERRY, was born near London, Jan. 16, 1872. He was educated at Bradfield College and at Heidelberg, and made his first appearance on the stage in *The Dead Heart* in 1889. In 1900 he produced Purcell's *Dido and Aeneas*, with revolutionary settings. His writings, which include *The Art of the Theatre*, 1905, *Towards a New Theatre*, 1913, and *The Theatre Advancing*, 1921, had an important influence on modern stage design. Exhibitions of his designs were given in several European capitals, and he staged classical productions in Berlin, Venice, Florence, Moscow and elsewhere. In 1928 George Tyler produced *Macbeth* at New York City with settings by Craig.

CRAIK, DINAH MULOCK (1826-87), English novelist, was born at Stoke-upon-Trent, Staffordshire, Apr. 20, 1826. When 23 years old she published her first novel, *The Oglivies*. John Halifax, Gentleman, her most famous work, was published in 1857, and was immediately successful. When granted a pension of £60 Mrs. Craik devoted it to the relief of needy authors. She produced over 40 works, including *A Life for a Life* and some stories for children. She died at Shortlands, Kent, Oct. 12, 1887.

CRAIOVA, capital of the Rumanian district Dolj in the province of Oltenia. Apart from Jassy it is the only city in old Rumania which is not completely overshadowed by Bucharest, but expresses itself in its own cultural and scientific circles and periodicals. It has many churches, a theater, and a museum. There are large banks, grain and flour mills and ceramic,

canned goods, soap and terra-cotta factories. Pop. 1930, 63,063.

CRAM, RALPH ADAMS (1863-), American architect and writer, was born at Hampton Falls, N.H., Dec. 16, 1863. He began work as an architect in 1889, and won recognition as an authority on medieval building, especially the Gothic style. He was supervising architect of Princeton University, 1907-29, and served as consulting architect of Bryn Mawr, Wellesley, and Mt. Holyoke Colleges. In 1911 he was appointed architect of the Cathedral of St.



COURTESY METROPOLITAN MUSEUM OF ART

FREDERICK THE WISE IN PRAYER BEFORE THE VIRGIN AND CHILD
From a woodcut by Lucas Cranach

John the Divine, New York City. He was professor of architecture at the Massachusetts Institute of Technology, 1914-21, and in 1915-22 was chairman of the first city planning board of Boston. He was also president of the Boston Society of Architects and clerk of the Medieval Academy of America. Among his principal writings are *The Gothic Quest* (1907), *The Ministry of Art* (1914), *The Substance of Gothic* (1917), *The Nemesis of Mediocrity* (1918), and *Walled Towns* (1919).

CRAMP, CHARLES HENRY (1828-1913), American shipbuilder, was born in Philadelphia, May 9, 1828. At twenty-one he became a partner in his

father's shipyards, William Cramp & Co. During the Civil War this company built monitors and ironclads for the U.S. Navy. Cramp was one of the leaders in changing the construction of ships from sail to steam and from wood to iron and steel. He built the *Kroonland* and the *Finland*, the two largest vessels constructed in the United States at the time of their launching. Many war vessels were also constructed in his yards for the Russian, Turkish and Japanese governments. Cramp was always an innovator, possessing an unquenchable flair for research. He died in Philadelphia, June 6, 1913.

CRANACH, LUCAS (1472-1553), German painter and engraver, the founder of the Saxon School, was born in 1472 at Cronach, in upper Franconia; his real name was Lucas Sunder. In 1504 he became attached to the suite of the elector of Saxony and in 1508 received from his patron the insignia of a winged snake, with which he signed all subsequent pictures. Cranach was among the household of the captive John Frederick I at Augsburg, where he executed those numerous portraits of the heads of the house of Wettin which rank among his best works. He also did portraits of the German reformers, including Martin Luther. His religious paintings lack

tenderness. The naive, little nudes of his mythological pieces have a quaint, unconscious humor. Cranach died at Weimar, Oct. 15, 1553. His son, Lucas Cranach, the Younger, (1515-86), was also a painter of distinction. The Metropolitan Museum, New York, has a *Madonna and Child* attributed to Cranach, the Younger.



AMERICAN CRANBERRY

pleasantly acid, berry-like fruits, widely used for pies, tarts, and sauces. The small cranberry (*V. Oxycoccus*), abundant in peaty swamps in sub-arctic and cool north temperate regions, bears bright red berries about $\frac{1}{4}$ in. in diameter. The large or American

CRANBERRY PRODUCTION, U.S.,

5-Year Average, 1926-30

Division	Production (Barrels)	% of Total
UNITED STATES	581,520	100.0
LEADING STATES:		
Massachusetts	383,000	65.9
New Jersey	131,400	22.6
Wisconsin	47,200	8.2
Washington	14,520	2.5

cranberry (*V. macrocarpon*), which bears dark red berries about $\frac{1}{2}$ in. in diameter, grows wild in boggy

places in the northeastern United States and adjacent Canada and is also extensively cultivated. Cranberry culture, which began in Massachusetts in 1808, is now of commercial importance, especially in Massachusetts, New Jersey and Wisconsin, the total yearly marketed yield usually exceeding a million bushels. See also VACCINIUM.

CRANDALL, PRUDENCE (1803-90), American Quaker educator, was born in Hopkinton, R.I., Sept. 3, 1803. In 1833, in Canterbury, Conn., she opened a school for "little misses of color," an act which antagonized the community and prompted the passing of the Black Law, under which her school could not operate. Miss Crandall was arrested and, although acquitted, was socially ostracized and finally forced to leave the state. She died in Elk Falls, Kan., Jan. 28, 1890.

CRANE, (ROBERT) BRUCE (1857-), American painter, was born in New York City, Oct. 17, 1857. He studied under A. H. Wyant and also in Europe. Noted for his American landscapes, he became a National Academician in 1901. Examples of Crane's work include *Autumn Uplands*, in the Metropolitan Museum, New York; *November Hills*, Carnegie Institute, Pittsburgh; *Autumn*, National Gallery, Washington; *March*, Brooklyn Institute; and *Springtime*, Peabody Institute, Baltimore.

CRANE, STEPHEN (1870-1900), American writer, was born in Newark, N.J., Nov. 1, 1870. He was educated at the Hudson River Institute, at Lafayette College and Syracuse University. After leaving college he went to New York City to earn his living by writing. He suffered much hardship, and saw the seamy side of life. His first book, *Maggie, a Girl of the Streets*, he published on borrowed money, but with the help of HAMLIN GARLAND, sold his second and most famous book, *The Red Badge of Courage*, 1893, to a syndicate. He wrote a number of vivid short stories, the best of which are in *Men, Women and Boats*. He also wrote two volumes of free verse, *War is Kind* and *The Black Riders*. As a writer of sardonic, realistic short stories, he ranks high in American literature. Crane went to live in England, where he earned the friendship of such men as JOSEPH CONRAD and HERBERT G. WELLS, and then was sent as a special correspondent to report the Spanish-American War and, later, the Graeco-Turkish War. He returned and died in Badenweiler, Germany, June 5, 1900.

CRANE, WALTER (1845-1915), English artist and author, was born at Liverpool, Aug. 15, 1845. His interest in art was aroused during his apprenticeship to a wood engraver (1859-62). He joined the English Pre-Raphaelites and like them extended his interest in art to the designing of stained-glass, tapestry, and especially to the illustration and decoration of books. It is in this last field that he is best known, although he won a place in the Tate Gallery with *The Birth of Venus*. In illustration he occupies an important place, his drawings for *The Faerie Queen*, *The Shepherd's Calendar*, and *The Lady of Shalott* being unique in design and execution. His work for

children was particularly charming, as in Grimm's *Household Tales*, *The Baby's Opera*, and Hawthorne's *Wonder Book*. He died in Horsham, Mar. 14, 1915.

CRANE, WILLIAM HENRY (1845-1928), American comedian, was born at Leicester, Mass., Apr. 30, 1845. He began his career as a singer but his first success was in the theatre, with Stuart Robson in 1877, in *Our Boarding House*, *The Henrietta*, and in Shakespearean comedy rôles. Later he became well known for his rôles in *David Harum*, *The Senator*, *A Virginia Courtship*, and *The American Minister*. He retired in 1916 but appeared occasionally in vaudeville and motion-pictures. He published *Footprints and Echoes*, 1927. Crane died at Hollywood, Calif., Mar. 7, 1928.

CRANE, a name given to a group of large wading birds in appearance resembling the herons and storks but in structure more closely allied to the rails. There are 19 species, all natives of the Old World except three found in North America. They inhabit plains and marshes, feeding on various plants and small animals and build nests on the ground laying usually two brownish, chocolate-spotted eggs. Unlike the herons they keep their long necks fully extended in flight. They migrate in large flocks, commonly at night, at an immense height, frequently uttering a very loud trumpet-like call. Cranes never rest in trees but when sleeping stand with one leg upon the ground, with the other drawn up under the body and the head thrust under the plumage of the back.

The whooping crane (*Grus americana*), a magnificent white bird fully 4 ft. long with a wingspread of 7½ ft., formerly abundant, is now one of the rarest North American birds. In the northern United States and also in Florida and southern Canada as far east as Michigan, the sandhill crane (*G. canadensis tabida*), gray and slightly smaller than the whooping crane, nests in diminishing numbers. The little brown crane (*G. canadensis*), a similar but smaller species nests further north and both species winter in Texas and California.

Among the best-known Old World species are the European crane (*G. grus*), the Asiatic white crane (*G. leucogeranus*), larger than the whooping crane, the paradise crane (*Tetraptyx paradisea*) of South Africa, the crowned crane (*Baeurica pavonina*) of Africa and the demoiselle crane (*Anthropoides virgo*), the smallest species found widely in Europe and Asia.

CRANE-FLY, many species of long legged mosquito-like insects (*Tipulidae* and related families) that often appear in great swarms over meadows and pastures. The larvæ vary greatly in their habits. Some are aquatic. Some live in or beneath damp moss. Others are found in mud or sand near streams, in swamps, or in shady woods. Still others are terrestrial. Most species feed on decaying vegetable matter, but a few eat living plant tissue, and still others are carnivorous. Some European and a few American species are destructive to the roots of plants in meadows and grain fields.

CRANES, structures that support the HOISTING

MACHINERY or apparatus used in lifting and moving material. Cranes may be either fixed or movable, but the latter are much more useful and in more general use. The usual traveling crane is a heavy beam or girder supported by rails and provided with wheeled trucks by which it can be moved from place to place. Another type of traveling crane is the "gantry" in which the girder is supported on long legs resting on trucks running on rails at ground level. "Jib" or arm cranes are usually attached to the wall or to a column and can only cover the space within the radius of the arm. In some cases the jib crane is supported, top and bottom, by a truck which has rails on the ground and overhead. This is sometimes called a walking jib crane. The actual lifting of the material is done by hoists attached to the cranes.

One type of jib crane is mounted on wheels or caterpillar treads and used in lifting materials and transporting it without regard to tracks or buildings. Others run on regular rail tracks around the shop yard. Some small industrial trucks, usually operated by storage battery, are also provided with small jib cranes as an aid to handling materials.

CRANFORD, a township of northeastern New Jersey, in Union Co., 10 mi. southwest of Newark. It is served by the Central Railroad of New Jersey and the Lehigh Valley Railroad. Cranford is chiefly a residential district of New York, and has few local manufactures. Pop. 1920, 6,001; 1930, 11,126.

CRANIAL NERVES. See BRAIN.

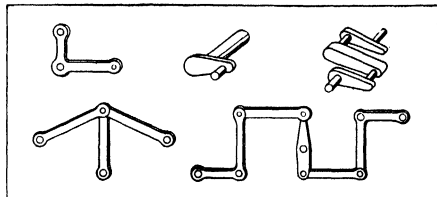
CRANIOLOGY, the study of the skull, is concerned chiefly with that of man and the other primates. Its purpose is to discover the significant differences between species, races and sexes, to record the characteristic growth changes, and to establish the limits of normal variation. Possible developments due to function or diet, and deviations rising from pathologic cause are also considered. Research is carried on by measurement and by observation of morphological characters. Diameters, circumferences and angles on the exterior and the volume of the interior are measured by methods established by the International Agreement at Monaco, 1906. The most commonly recorded diameters are the maximum length, breadth and height of the skull and the lengths and breadths of the face and the nose. Of the indices derived from these cranial measures, the cephalic index, $\frac{\text{Breadth} \times 100}{\text{Length}}$, is the most widely used. The facial

angle which determines the degree of prognathism is an indicator of race and species.

The science of craniology began in the 18th century with the work of Peter Camper (1722-89), John Hunter (1728-93) and Johann Friedrich Blumenbach (1752-1840). From the Paris laboratories of Paul Broca (1824-80) came considerable progress in technique and knowledge. Rudolf Martin of Munich who died in 1925 was the chief compiler of world-wide data. To Karl Pearson and his associates at the London School of Economics, we owe the great advance in the statistical treatment of craniometric ma-

terial. Among contemporary American scientists engaged in craniology, perhaps the most outstanding are Ales Hrdlicka, Earnest A. Hooton and T. Wingate Todd. The leading journals in which recent results of craniology can be found are the *American Journal of Physical Anthropology*, founded 1918, the *Anthropologischer Anzeiger*, 1924, and *Biometrika*, 1901. See OSTEOLOGY for bibliography. R. S. W.

CRANKS are usually levers fastened to a shaft, either for driving the shaft or for transmitting motion from the shaft. They are also formed by bending the shaft itself, either at the end or anywhere in its



VARIETIES OF CRANKS

Left to right: Bell crank, single throw crank, double throw crank, (lower) toggle and linkage combinations

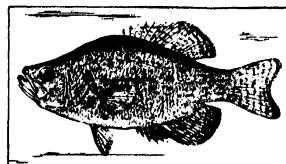
length. Generally they are used to transform reciprocating motion into rotary motion, as in the steam or gas engine, but sometimes for the reverse as in the motor-driven air compressor.

CRANMER, THOMAS (1489-1556), archbishop of Canterbury, was born at Aslacton, Nottinghamshire, England, July 2, 1489. He was educated at Cambridge. He was advanced rapidly by Henry VIII, whom he helped to obtain the marriage annulment from Catherine of Aragon, Cranmer pronouncing the marriage invalid when he became archbishop, in 1533. He had himself married the year before and thus started his own abjuration of Rome, which was made decisive in 1535, when he became one of the chief promoters of the reformation in England. In 1547 he was made one of the regents for Edward VI. The next year he began his greatest work as head of the commission which prepared the first *Book of Common Prayer*, whose stately language is largely due to him. Under Queen Mary he was imprisoned for heresy and was burned at the stake at Oxford, Mar. 21, 1556.

CRANSTON, a city of Providence Co., R.I., bordering on the city of Providence, on Narragansett Bay and served by the New Haven Railroad. Within the city limits are several villages, manufacturing cotton goods, machinery, fire extinguishers and other commodities. In 1929 the value of the factory output was about \$21,000,000; the retail trade amounted to \$5,381,980. Agricultural pursuits are also of importance. A local state farm includes several state and county institutions for dependents and delinquents. Settled about 1640 as part of Providence by Roger Williams's companions, in 1754 Cranston became a separate town, named for an early governor of Rhode Island, Samuel

Cranston, and was chartered as a city in 1910; between 1868 and 1892 three sections were reannexed by Providence. Pop. 1920, 29,407; 1930, 42,911; 25% foreign-born.

CRAPPIE (*Pomoxis annularis*), a sunfish found from New England to New York and throughout the Mississippi Valley and Great Lakes region. It is popularly called campbellite, tin-mouth, sac-a-lait, and chinqua-pin perch. The crappie is an excellent food



CRAPPIE

fish closely related to the calico bass and is gamey when it does not inhabit sluggish water. Its short, wide body is greenish-silver, with dark, green spots, lengthening into bars on the upper body and fins. The dorsal fin has from four to six spines.

CRASSUS, MARCUS LICINIUS (c. 115-53 B.C.), Roman triumvir, whose political prominence resulted largely from his enormous wealth. Assisting the companies of Roman knights which farmed Rome's revenues from her provinces Crassus' influence with the equestrian class was great. After crushing a slave revolt in Italy led by Spartacus and holding the consulship jointly with GNAEUS POMPEY in 70 B.C., he formed with JULIUS CAESAR and Pompey the coalition known as the FIRST TRIUMVIRATE, 60 B.C. Less forceful than his colleagues Crassus served as a check upon the rival ambitions of Caesar and Pompey. After a second consulship, 55 B.C., he assumed the administration of Syria. Undertaking an expedition into Mesopotamia against the Parthians his army was overwhelmed at Carrhae in 53 B.C. Crassus was captured and put to death by Surenas the Parthian commander.

CRATER (gen. *Crateris*), the mixing-bowl, a small and inconspicuous constellation between Hydra and Corvus. See STAR: map.

CRATER, the circular pit in the summit of a volcanic cone or mountain. Craters vary from a few hundred yards to a mile or more across. They may be symmetrical or broken down on one side. The crater of a mildly active volcano, like Vesuvius, is constantly changing shape, as the discharge of cinders, lava, and rocks builds up the cone. In violent eruptions, the lava stream often bursts through the side of the cone. The whole mountain-top may be blown off, leaving a shallow crater of great diameter, called a caldera. When no signs of explosive eruption appear, an extinct caldera is assumed to have resulted from the caving in of a volcanic cone. Such depressions often fill with water, forming CRATER LAKES.

CRATER LAKE NATIONAL PARK—CRATINUS

The largest active crater in the world is Kilauea, opening on the slope of Mauna Loa, in Hawaii. From the crater rim, eight miles in circumference, a steep trail leads to the black crusted lava floor, 500 to 800 ft. below, where at the southwestern end flames the spectacular Halemaumau, or "lake of eternal fire." The molten lava, surging against the walls of its pit, throws lava jets 200 to 300 ft. into the air.

CRATER LAKE NATIONAL PARK, in the heart of the Cascade Mountains in southwestern Oregon, was established May 22, 1902. The park has an area of 249 sq. mi. Crater Lake itself is 6 mi. in



COURTESY AMER. MUS. OF NATL. HISTORY

GEOLOGICAL MODEL OF CRATER LAKE

diameter. Its walls rise to a height of over 1,000 ft. and are formed of fantastically contorted lava. The waters of the lake vary from a light turquoise near the shore to an intense shade of Prussian blue in the deeper parts. At some places the lake attains a depth of 2,000 ft. There is no known outlet but the lake's waters are supposed to escape by underground channels to enter the nearby Klamath River.

Crater Lake is of interesting geologic formation. In past ages a Mt. Mazama, almost as high as Mt. Rainier, elevation 14,408 ft., was a tremendous volcano. As a result of some titanic cataclysm, the entire upper portion of this mountain collapsed into the bowels of the earth leaving a hole of unusual depth. Lesser cones arose within the crater but none so high as the original mountain. A climb up the rugged sides of Wizard Island is rewarded by a glimpse into one of these little craters. Another curiously contorted and carved island of lava is called the Phantom Ship. At a distance the outlines definitely suggest a ship under full sail, and at sundown or by moonlight the illusion is striking. In certain slants of light, this Phantom Ship strangely and suddenly disappears.

Boats take visitors round the lake which abounds in fish. The Rim Road, a 34 mi. highway encircling the rim, offers superb views of the surrounding country as well as of the lake.

The park is reached by U.S. Interstate Highway No. 97A, part of the National Park to Park Highway. Visitors travelling by train may take an auto stage to the park from Medford or Klamath Falls on the Southern Pacific Railroad.

Educational. Sinnott Memorial, an attractive stone building constructed on Victor Rock on the rim of the lake, contains instruments, specimens, diagrams and

other exhibits to assist the visitor in understanding the geological history of Crater Lake. Other educational facilities include self-guiding nature trails on which flora and places of geological interest are carefully labeled, lectures by ranger naturalists and guided field trips and auto caravans escorted by the park naturalists.

CRATER MOUND, an unusual geological formation in central Arizona, about 10 mi. south of Sunshin, Ariz. and 40 mi. southeast of Flagstaff. It was first known as Coon Butte and later as Meteorite Mountain.

Crater Mound is 100 to 150 ft. high and from the Santa Fe railroad which passes to the north it appears to be a low ridge of no particular interest. It is, however, circular in formation and encloses a deep crater-like hole 4,000 ft. in diameter and 600 ft. deep. The encircling ridge is composed of rock and sandstone fragments which apparently have been blown up from the hole. In the walls are beds of limestone and sandstone. Geologists have been unable to work out a satisfactory explanation for Crater Mound. Bits of meteoric iron found in the vicinity led to the theory that it was caused by the impact of a huge meteor. Borings to a depth of 200 ft. and tests with a magnetic needle have failed to substantiate disturbance of the underlying sandstone or to indicate the presence of a large mass of metallic iron. Another theory is that steam from volcanic sources below accumulated in the porous sandstone until it gained sufficient pressure to explode. This theory would account for the angle of the rock strata in the walls of the hole and for the fragments of rock and sand in the rim.

CRATERS OF THE MOON, a national monument, 49,601.90 acres in area, at the foot of White Knob Mountain in south central Idaho. The region is characterized by weird landscape effects due to fissure eruption and lava flow and, as its name signifies, closely resembles the appearance of the surface of the moon when viewed through a telescope. Cinder cones, craters, and hornitos vary from 20 to 600 ft. in height. There are large areas covered with lava. Tunnels formed by fresh lava flowing out from under a hardened crust are as much as 30 ft. in diameter and 100 ft. long and contain beautiful red and blue stalactites and stalagmites. Scientists believe that the volcanic eruptions which formed this region occurred spasmodically for a period of at least 1,000 years and may have stopped but a few hundred years ago. The monument, created May 2, 1924 and enlarged to its present area July 9, 1930, is administered by the National Park Service of the Department of the Interior. The entrance is on the Idaho Central Highway which connects Boise and all western points with YELLOWSTONE NATIONAL PARK. The nearest railroad connection is at Arco, 23 mi. distant, on the Oregon Short Line.

CRATINUS (c. 520-423 B.C.), Greek comic poet and dramatist, probably born at Athens about 520 B.C. He was a contemporary of Aristophanes whom once he triumphed over in competition, with his *Wine*

Flask. Cratinus did much to improve Greek comedy, especially the chorus. He wrote 21 plays, all known for their invective and satire. He died about 423 B.C.

CRAWFORD, FRANCIS MARION (1854-1909), American novelist, was born at Bagni di Lucca, Italy, Aug. 2, 1854, the son of Thomas Crawford, the sculptor. He studied at Trinity College, Cambridge, Heidelberg, the University of Rome and Harvard. While in India he edited the *Indian Herald* at Allahabad. His first novel, *Mr. Isaacs*, published 1882, won a great success. Other popular books were the *Saracinesca* series, 1887-92, and *Via Crucis*, 1899. Sarah Bernhardt produced his play, *FRANCESCA DA RIMINI*, in Paris in 1902. Crawford died at Sorrento, Italy, Apr. 9, 1909.

CRAWFORD, THOMAS (1814-57), American sculptor, was born at New York City, Mar. 22, 1814. He studied under Thorwaldsen at Rome and later produced his equestrian statue of Washington which now stands in Richmond, Va. One of his most famous works is the colossal statue of *Liberty* on the dome of the Capitol at Washington, D.C. Crawford died at London in 1857.

CRAWFORD, WILLIAM HARRIS (1772-1834), American statesman, was born in Amherst Co., Va., Feb. 24, 1772, and in 1798 began the practice of law in Georgia. As a United Senator in 1807-13, he was a prominent advocate of rechartering the Bank of the United States, and as Secretary of the Treasury in 1817-25 he established an efficient cooperation between the Treasury Department and the Second Bank of the United States. In 1824 he received the nomination of the Congressional caucus for the Presidency, but the decision of the caucus was challenged by Jackson, Adams and Clay. In the ensuing campaign, Crawford suffered a stroke of paralysis and was compelled to withdraw. Even then, he received 41 electoral votes, running behind Jackson and Adams. Since no one had a majority, the election was referred to the House of Representatives, which chose Adams. After 1827 Crawford served as a circuit judge in Georgia until his death in Elberton, Sept. 15, 1834.

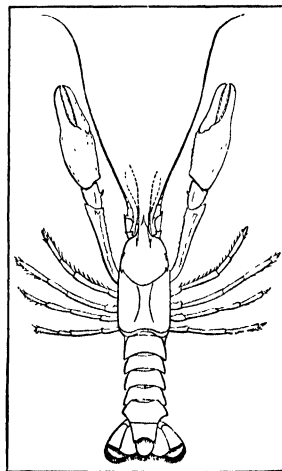
CRAWFORD NOTCH, a deep and highly picturesque defile cut by the Saco River through the White Mountains, New Hampshire, between Mt. Willey and Mt. Willard on the west and Mt. Webster and Mt. Jackson on the east. The granite walls rise approximately 1,900 ft. on either side of the gorge for a distance of 3 mi. Beautiful cascades tumbling down from dizzy heights and fantastically eroded rock formation enhance the scenic beauty of the notch. Approximately 6,000 acres in the region have been made into a state forest by New Hampshire.

CRAWFORDSVILLE, a city in western Indiana, the county seat of Montgomery Co., situated 40 mi. northwest of Indianapolis, on Sugar Creek. It is served by bus lines and three railroads. This region produces pedigreed cattle, hogs, sheep and poultry, and raises large crops of wheat, corn and oats. The city manufactures chiefly library tables, nails and wire. In 1929 the manufactures reached an approximate total

of \$6,000,000; the retail trade amounted to \$6,340,807. It is the seat of Wabash College, founded in 1832 by Presbyterian missionaries. Crawfordsville was settled about 1823 and chartered as a city in 1863. Turkey Run State Park is several miles southwest. Gen. Lew Wallace, author of *Ben Hur*, made his home here, as did Kenyon Nicholson, the playwright, and also Meredith Nicholson, author of *The House of a Thousand Candles*. Pop. 1920, 10,139; 1930, 10,355.

CRAYFISH, the common name for freshwater crustaceans, belonging to the same order (*Decapoda*) as the lobsters, which they very much resemble in looks. There are two families, one (*Astacidae*) inhabiting the northern hemisphere, and the other (*Parastacidae*) confined to the southern hemisphere. They live in rivers and streams in most parts of the world, but none are found in equatorial regions or in Africa.

Like many crustaceans, crayfish are protected by a horny armor, which must be moulted periodically because it cannot grow with the animal. They are



BLIND CRAYFISH
(*Cambarus pellucidus*.) Found in caves in
Kentucky and Indiana

greenish or brownish in color, and usually from 3 to 6 in. long. Their first conspicuous appendages are two big, grasping pincers or claws. Behind these are four pairs of walking legs. If they are caught by a leg they can shed it, and soon grow a new one in its place. The animals live under stones, or in burrows which they usually dig in wet soil. They go hunting, generally at night, for whatever animal food they can find, and they are not averse to eating carrion. In the breeding season, the fall, the female curls up her tail to form a basket, and here she carries her eggs until they hatch the next summer.

Crayfish may be taken in nets baited with de-

caying meat. They are edible, and many of them, particularly some of the larger Australian species such as the Murray River lobster, are considered great delicacies. Sometimes they become troublesome because, burrowing in dikes and levees, they let the water through.

CRAYON DRAWING. Black crayon is chalk and black lead, red crayon is ochreous clay containing red iron oxide, white crayon is chalk; colored crayons are made from a base of china clay, compounds of magnesium and talc to which is added vermilion, chrome yellow, Prussian blue and umbers in varying quantities together with an adhesive element.

Charcoal and red chalk were used in the 18th century, but it was the great masters of the 16th century who first used crayon with other mediums to heighten effects and suggest color. In the portrait drawings of HANS HOLBEIN the Younger (1497-1543) are some of the finest examples of crayon drawing. J. A. WATTEAU (1684-1721) was also a master of this medium, achieving remarkable effects by rubbing two colors together. Celebrated examples of crayon drawing were made by FRA BARTOLOMEO, LEONARDO DA VINCI, MICHELANGELO, TITIAN, REMBRANDT, PUVIS DE CHAVANNES and J. M. WHISTLER.

CREAM-CUPS (*Platystemon californicus*), a low annual herb of the poppy family common from California and Lower California to Arizona and Utah, and sometimes grown in gardens. It is a soft-hairy



FROM JEPSON. MAN. FL. PLANTS CALIF., COPYRIGHT
CREAM-CUPS

plant, about 9 in. high, with slender, widespreading basal branchlets, narrow leaves, and attractive, light-yellow or cream-colored flowers.

CREAM OF TARTAR, a white, crystalline, acid substance known chemically as potassium hydrogen tartrate ($\text{HKC}_4\text{H}_4\text{O}_6$), used with baking soda (NaHCO_3) as a constituent of baking powder. It reacts with the sodium carbonate produced from baking soda, which otherwise would give bread an acrid taste

and yellow color. Cream of tartar is crystallized from a solution of argol.

CREAM SEPARATOR. See DAIRY MACHINERY.

CREASY, SIR EDWARD SHEPHERD (1812-78), English historian, was born at Bexley, Kent, in 1812, and educated at Eaton and Cambridge. He was admitted to the bar in 1837 and was assistant justice at Westminster sessions court until 1840, when he became professor of history at London University. In 1852 he published *The Fifteen Decisive Battles of the World*, for which he is best known. Beginning in 1860 he served ten years as chief justice of Ceylon. He died in London, Jan. 27, 1878.

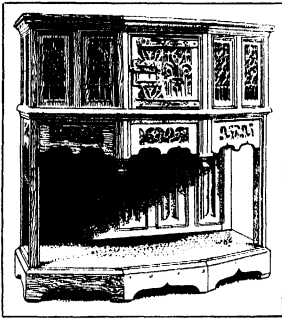
CRÉBILLON, CLAUDE PROSPER JOLYOT DE (1707-77), French novelist, was born at Paris, Feb. 14, 1707, the son of Prosper Jolyot de Crébillon (1674-1762). In 1734 he published *L'Écumoire*, which, on account of its attacks on prominent persons, gained for him a term of imprisonment and exile from Paris for 5 years. In 1784 he married Lady Henrietta Maria Stafford, his happy married life presenting considerable contrast to the immoral tone of his novels. In 1759 he was appointed censor, a somewhat strange post for a man whose own works were considered by many to be in need of censorship themselves. Crébillon died in Paris, Apr. 12, 1777.

CRÉBILLON, PROSPER JOLYOT DE (1674-1762), French dramatic poet, was born at Dijon, Jan. 13, 1674. He was educated for the law, but in 1705 successfully produced *Idoménée*, and, in 1711, his masterpiece, *Rhadamiste et Zénobie*. Embittered by later theatrical failures, and the machinations of his rivals, among which were Voltaire, he lived in seclusion for many years. Happily, he was elected to the French Academy in 1731, was pensioned by Madame de Pompadour, and his tragedies were again successful. He died at Paris, June 17, 1762.

CRÉCY or CRESSY, BATTLE OF, Aug. 26, 1346, a combat in which Edward III of England, with an army of about 20,000 men obtained a brilliant victory over Philip of Valois. After the unsuccessful siege of Rouen, the capital of Normandy, Edward and his son, the Black Prince, retreated before the superior French force of about 60,000. The Count of Alençon, who commanded, overtook Edward and brought him to a stand at Crécy. The English, with the help of their long-bows, held their lines against the attacks of the French cavalry and threw the enemy's ranks into confusion. The English were now able to take the offensive. The personal valor of Philip and his heavily armed nobles and men could not avail against the English and Flemish foot-soldiers. Ralph, Duke of Lorraine, James, the King of Majorca, and the almost blind King John of Bohemia, who was fighting for France, were slain in the battle, together with the flower of French cavalry. Accounts of their losses vary from 20,000 to 30,000.

CREDESCENCE or CREDESCENZA, a sidetable with a small drawer or cupboard. Evolved from the chest,

in medieval times the credence was used by the food-taster, who guarded the diners against poisoning. Later it developed into the CUPBOARD or BUFFET. The name is now applied to an ecclesiastical table or



COURTESY METROPOLITAN MUSEUM OF ART
OAK CREDESCENCE IN FRENCH GOTHIC STYLE

shelf placed near the communion table or altar, where bread and wine and other articles are set for use in the service.

CREDENTIALS, a "letter of credence" issued by a state accrediting a diplomatic representative to a foreign government, authorizing him to carry on diplomatic relations (*see* DIPLOMACY) with the receiving state in the name of his sovereign or government. The letter of credence is presented by its holder to the sovereign at the time of his reception. The term also includes any commission or authorization of a diplomatic official on special or permanent appointment.

CREDIT, may be broadly defined as a system for the non-monetary exchange of goods. Among other meanings currently used are those of a "short sale of money," a contract to deliver money, a substitution (and exchange) of future for present values; and a means of cancelling indebtedness so as to settle balances only. The outstanding source of interest in credit is, however, found in its service as a means of exchanging goods. Hence, the definition of credit as a developed and worked-out plan, whereby goods are exchanged without the use of money seems to bring into the foreground the essential characteristic of the credit process.

Classes of Credit. The analysis of credit is a comparatively new branch of banking and monetary study; and authorities are not agreed in their classifications of it. The prevailing groupings of credit employ three main bases of analysis: that which classifies credit according to the industry in which it is used, e.g., mercantile, bank, investment, manufacturing credit and the like; that which uses time or period as a criterion, e.g., long-term, short-term, intermediate, and other credit; and that which groups credit according to a supposed difference in quality, e.g., liquid credit, unliquid paper, and "frozen" assets. The lines

of distinction between these various groupings are somewhat blurred and conflicting, because of lack of self-consistency in the discussion. Thus bank credit is often identified with short-term credit, and both are at times identified with liquid credit. The fault in the classification lies in regarding credit as a substantive thing, whereas it is really a process. There is no real difference in the credit which underlies retail trade transactions and that on which banking rests, but there are wide differences of technique and practice. Colloquially, there may be reason for the continued use of the classifications just given, because they still connote each a given set of notions in contemporary literature. The student should, however, remember that credit, being a system or plan for the non-monetary exchange of goods, is the same wherever employed, although subject to variations in means of adjustment.

Theory of Credit. It is evident that the definition thus adopted makes necessary a theory designed to exhibit the ways in which credit is created, developed and destroyed, as well as an interpretation of the effects of its use. It is created or brought into use, whenever there is a gap between production and consumption. Thus, if a trapper exchanges furs for wheat with a farmer the operation is called barter, because consumption goods have been received by each side, and the transaction is closed or settled. If a trapper sells his furs to a furrier for money after which they are bought by a farmer the transaction is a sale or series of sales. Where any transaction is not closed but is merely evidenced by a book-entry or some other means of recognizing the fact of the transfer, ultimate closing being deferred, the result is a credit operation. Selection of the commodity which is to be called for in settlement of the original transfer of goods is postponed. The period during which such postponement of consumption takes place is called the duration or life of the credit. Evidently, if those who accept credit from others at a specified valuation of goods never make errors, but are always correct in their judgments, existing transactions ought at all times to "clear." This correctness is never perfect, while credit contracts differ in time. Perfect clearance is seldom or never possible, and thus it often happens that credit is frozen, i.e., those who made the credit contracts are not in position to fulfill them on the dates when they are due. Because of the fact that holders of credit claims against others may ask to have them carried out, an institution engaged in credit transactions does well to carry among its assets some immediate means of settlement to bridge over periods of sudden demand for the fulfillment of credit contracts. Where such means of payment is carried in cash, it is usually called a reserve. Its presence is most essential in the case of concerns which are largely engaged in credit operations, or which have established enterprises largely devoted to the judging of credit. The amount of such reserve clearly depends both upon the amount and upon the duration or life of the total credit outstanding. Thus the effect of a well-organized credit

system is clearly to keep prices at or near their true, or normal, or permanent level of value, by keeping demand well adjusted and active.

Credit Institutions. It is obvious that, as soon as credit transactions pass beyond the stage in which values may be judged on a very short-term basis by comparisons of strength of demand on the part of consumers, the ascertainment of accurate measures of credit becomes a difficult process. Where the values are measured in money, such ascertainment requires general knowledge of market conditions, and of quotations; where they are not so measured, it involves a close knowledge of purchasing power in various technical branches of trade, or production. Study of credit then becomes a profession; and with it is usually associated the guaranteeing of the correctness of the judgment thus established. The general term "Credit institutions" is broadly applied to all institutions or organizations which facilitate the exchange of goods, whether consumption or capital. In such a classification are included banks, trust companies, building loan associations, rural-mortgage banks and a variety of others.

Measurement of Credit. Some means of ascertaining how largely the business of the community is being carried on without the use of money is clearly desirable for many reasons; hence the development of measures of the amount of credit in use at any given moment. Complete statement of the credit in use at any time would necessitate a summary of the totals carried on merchants' books, through individual advances, in the form of loans made by banks, and in many other different ways. It is impossible to obtain statistics that would be even approximately trustworthy in these various fields. Accordingly, it is customary to select some representative measure which ordinarily fluctuates in accordance with the total amount of credit probably used at a specified moment. Different measures of this sort have been suggested from time to time. One of the commonest is furnished by the volume of deposits in banks. Since, however, deposit accounts are drawn upon over and over again, it has been customary to hold that the volume of credit must be determined by multiplying the total numerical amount of deposits in existence by the number of times they turn over in a given period. The debits to individual account in a select number of banks or the clearings at specified clearing houses, are, therefore, often employed as a measure of credit volume in use.

Granting of Credit. By granting credit is usually meant the ascertainment of the total, stated in dollars or otherwise, which the credit institution regards the credit applicant as able to liquidate. This process requires inquiry into two main matters—the solvency or net asset position, and the liquidity or relation between Assets and liabilities of similar life or duration, by which the applicant is characterized. This inquiry may be a matter of lengthy investigation or of hasty and approximate settlement. In the larger banks, it is being more and more closely governed by

scientific principle, and is usually entrusted to a credit analysis department, highly organized and operated by skilled men. If general mistakes are made in the process of granting credit, so that more of it than can be liquidated in the required time, is established, inflation results; and, conversely, if too little be granted as compared with the ability of the community to liquidate there is deflation. *See also* INFLATION AND DEFLATION. H. P. W.

CREDIT, LETTER OF. *See* LETTER OF CREDIT.

CREDIT ECONOMY, the methods and measures by which commodities are exchanged in modern business uninterrupted either by deferred delivery or deferred payment. Due to the extension of the world's credit machinery in the past century both deferred payment of MONEY and deferred delivery of commodities have become the rule in business. BANKS exist for the purpose of organizing CREDIT for the convenience of commerce and industry. By means of credit physical transfer of money at the time of a transaction is unnecessary. In the economic sense, credit indicates power secured over commodities by full payment of money to a bank in advance. When the depositor of money makes a purchase he directs that ownership of such a part of the money as is involved, be transferred to the seller. Thus the money is not disturbed physically, the transfer merely taking place on the books of the bank. This leads to great economy of Gold and Currency.

Back of the banking structure there must be a large volume of reserves of gold and currency either as a matter of law or custom, since credit is a promise to pay money. The cash reserves of the banks support the superstructure of credit and insure that depositors can make good their claims to cash whenever they desire it. However such claims are not made as long as the depositors are confident that cash is amply available. Only when confidence is undermined do depositors make a run on banks for cash. The relationship of credit to cash rests upon a difference in the degree of acceptability of the two media of exchange. In general credit instruments acquire acceptability according to the character and resources of the borrower. Occasion for credit arises out of present day industrial processes in which a series of productive and distributive operations cause many transfers of ownership between the beginning of production and ultimate consumption when the account is finally liquidated. Credit is the instrument by which this gap is bridged.

CRÉDIT FONCIER, a French banking institution under government supervision with its main office in Paris. It was organized in 1852 to regularize and standardize the extension of credit on real property. It makes long-term loans on first mortgages to the extent of half the value of the property, both principal and interest being payable in annual installments. In the 1870's the standing of the *Crédit Foncier* was temporarily impaired when a subsidiary institution, the *Crédit Agricole*, was forced into liquidation by the suspension of payments on rather speculative loans totaling 168,000,000 francs made by it

to the Egyptian government. Besides its real estate loans, the *Crédit Foncier* arranges for the extension of credit to towns, departments and other public bodies.

CREDIT INSURANCE, an agreement to indemnify against loss through bad debts which may be secured by merchants and business men. The applicant for this insurance is required to supply a statement of his credits and his losses over a period of years. No credits may be listed save those granted to firms which have been rated by the accepted mercantile agencies, and the amount of CREDIT extended to them cannot be more than 20% of their lowest rating. The average annual ratio of losses to credits is obtained from this statement and the insurance applies to it, indemnity being granted only for a loss in excess of this average annual ratio.

CRÉDIT MOBILIER, a French banking institution, founded in 1852 as the *Société Général du Crédit Mobilier*, for the purpose of making loans and creating credit based on personal rather than real property. It was chartered primarily to encourage industrial development. It was, therefore, granted wide powers, to make loans, buy and sell stocks and issue bank notes. In its first four years the *Crédit Mobilier* justified the charges made by its opponents that it would be "a great gambling establishment." It made tremendous loans to industries and the government, paying its stockholders dividends which ran up to 40%. In 1856 the government stepped in to restrain the grandiose plans of the officers of the company. From that time on the fortunes of the *Crédit Mobilier* waned rapidly. It was reorganized in 1871 and again in 1884 with greatly reduced capital. Since then it has played only a minor rôle in French finance.

CREDIT MOBILIER OF AMERICA, an organization formed by Oakes Ames and other shareholders and promoters of the Union Pacific Railway to serve as a construction company for that road following its final authorization by Congress in 1864. In addition to giving the promoters a franchise, the right of way, and huge areas of the public domain in the form of land grants, Congress had loaned them \$27,000,000 in Federal bonds. Under the terms of the acts of Congress, Union Pacific shares were to be sold for cash at par. As a matter of fact, the insiders in the construction company paid for them in roadmaking at not in excess of one-third their par value. Congressional investigations of 1872-73 established the facts that, as far back as 1867, Ames, since 1863 a member of the House of Representatives, had apparently feared a Congressional investigation, that he had had transferred to him as trustee a bloc of Credit Mobilier stock, that he had made contracts with various Senators and Representatives to sell them this stock at par, though it was worth 200 at the time, that some had paid, that Ames had carried others, and that in 1868 Credit Mobilier had cut a melon in stocks and bonds of the Union Pacific worth in cash about \$350 for each \$100 invested. The Congressional committees held that most of the Congressmen had taken the stock without realizing they were guilty of any im-

propriety or even indelicacy. Although Ames and Brooks of the House and Patterson of the Senate were severely censured, no change was made in the distribution of the Union Pacific returns. C. A. G.

CREE or PLAINS-CREE, an important western Algonkian tribe. Their aboriginal habitat was between the Red and Saskatchewan rivers in Canada, though they roamed down the Nelson River north-eastward to Hudson's Bay and northwestward to Athabaska Lake. An eastern group called the Eastern Cree still lives around James Bay. Linguistically the Cree are closely related to the Chippewa and Maskogon. They were nomads and though originally a forest people, or belonging to the northern group of the Eastern Woodlands area, have for only a few hundred years been in the northern boundaries of the Plains. They were closely allied in historic times with the Assiniboin with whom they made common cause against the Blackfoot and Dakota, Gros Ventre and the Crow. They also made extensive raids into Athapaskan territory as far north as the Mackenzie River. In culture they possess traits characteristic of both the Woodlands and Plains. They lived in tipis, hunted the buffalo and were adept in the use of the buffalo-pound or drive. Their social and political organization was simple. They celebrated the sun dance, its form being like that of the Blackfoot.

CREEDS, originally, in the early Christian Church, baptismal confessions. The term is supposed to have been derived from the first word, *Credo*, I believe, of the so-called Apostles' Creed, the oldest of the authoritative summaries so named. The importance of this creed is such that it is sometimes referred to simply as "The Creed," and its well-known form lies at the root of nearly all later summaries of belief. Among the other famous creeds of Christendom are the NICENE, 325; the ATHANASIAN, 5th century, A.D.; the Creed of Chalcedon, 451, which affirmed the divine and human nature of Jesus; and the Creed of Pius IV, published in 1564, consisting of the Nicene-Constantinopolitan Creed with a summary of the definitions of the Council of Trent and a profession of belief in the definition of the Vatican Council.

Almost as early is the recital of a creed by the priest or congregation as part of the service of worship. Since the Protestant Reformation, creeds have mostly become "Confessions," usually a longer exposition of the essential points of belief. The best-known Confessions are the Augsburg Confession (1530) of the Lutheran bodies, the Geneva Confession (1545) of Calvinism and the Heidelberg Confession of 1563. In the established Church of England the 39 Articles form the dogmatic formulation. In Scotland the Confession of Knox (1560) and the Covenant (1581) prepared the way for the Westminster Confession (1645) which lies at the foundation of Presbyterianism. The modern tendency is to stress only those points which most churches can most easily unite upon, or to omit the creedal requirement of membership entirely.

CREEK, an important confederacy which appears to have been in existence at the time of De Soto's

expedition in 1540. They were the most numerous division of the Muskogean linguistic stock. They occupied, during the early historic period, most of Alabama and Georgia. So powerful was this federation that they resisted the attacks of the more northern tribes, the Catawba, Iroquois, Shawnee and Cherokee. Prior to their removal to Oklahoma, between 1836 and 1840, for about a hundred years they occupied some 50 towns where six distinct languages were spoken, the Muscogee, Hitchiti, Koasati, Yuchi, Natchez and Shawnee, the first three being Muskogean. These towns were themselves classed as Upper Creek, on the Coosa and Tallapoosa rivers, Alabama, and Lower Creek, on the middle and lower Chattahoochee River. They had a well-defined social organization, an exogamous clan system, with descent in the female line, and a system of ranking chieftainships. Like other southeastern Indian tribes, their most important ceremony was the Busk or "new fire" ceremony. They have carried over some of their ancient political organization to their present home in Oklahoma where they live in 49 towns.

CREEK, a name given in the United States to small streams, intermediate between a brook and a river, which flow into some other body of water, making an inlet in its shoreline. In parts of the southern states, streams of this type are termed bayous. In Australia the name creek is sometimes applied to long streams, which in the dry season dwindle to a chain of waterholes.

CREEK WAR, a conflict between the United States and the Creek Indians of the Mississippi Territory during the WAR OF 1812. The Indians realized that the United States, hard-pressed by England in the East and North, was weak militarily in the South. Encouraged by the British, a large force of Creeks fell upon Fort Mims, a stockade 35 miles north of Mobile, Ala., and, despite the heroic resistance of the defenders, massacred 538 men, women, and children on Aug. 30, 1813. Tennessee troops and volunteers, led by Gen. ANDREW JACKSON, advanced into the Creek country and on Mar. 27, 1814, at Horseshoe Bend, Ala., the opposing forces met. In the battle more than 2,000 warriors were killed. As a result of the battle, the Creeks surrendered a large part of their territory to the United States.

CREEP. Ductile metals subjected to static tensile stress for a long period will break at a lower stress than that required for breaking them rapidly. Lead, tin and zinc exhibit "creep" at normal room temperatures; steels and other strong alloys do at higher temperatures. "Creep" at any temperature often consists in three stages, a short initial one during which the rate of flow decreases, a second and most important state in which the flow may be very slow, and finally one of rapid extension preceding fracture. The temperature at which a metal shows maximum total extension of one per cent in 10,000 hours under a given stress is used very widely as a basis of engineering design of apparatus to operate at high temperature.

CREEPER (*Certhia familiaris*), a small, curious, somewhat wren-like bird found widely throughout the north temperate zone. The brown creeper (*C. f. americana*), the variety best known in North America, breeds mainly in southern Canada and the northern border of the United States from Minnesota eastward and is a winter visitor somewhat farther south. It is about 5½ in. long with dark brown back somewhat streaked with white and white underparts. It has long sharp claws adapted for climbing, and a relatively long curved bill. In company with the nuthatches and smaller woodpeckers it visits many kinds of trees in search of insect food using its tail as a prop in climbing, and spiralling about the tree from its base upward. The brown creeper nests under the loose bark of dead trees laying 6 to 8 yellowish-white, purple-dotted eggs. Four other very similar varieties of the creeper occur in the western United States and two in Europe, the familiar tree creeper of Europe belonging to this species.



G. M. SUTTON, "BIRDS OF PA."
J. HORACE McFARLAND CO. COPYRIGHT
BROWN CREEPER

CREEPING BARRAGE. See BARRAGE.

CREFELD, a Prussian city near the Rhine, about 12 mi. northwest of Dusseldorf. It is a center of the German silk and velvet industry. Crefeld is regularly built, with wide streets, several squares and pretentious buildings of recent decades typical of a growing manufacturing city. It was mentioned first in 1166. Charles IV conferred market rights upon it in 1361 and a city charter in 1373. The city did not flourish, however, until the 17th and 18th centuries, when a number of Protestants of various sects took refuge there. Pop. 1925, 131,098.

CREIGHTON, MANDELL (1843-1901), English prelate and historian, was born at Carlisle, England, July 5, 1843. Educated at Durham and at Merton College, Oxford, he was elected fellow and tutor at the latter in 1866. From 1875 to 1884, he was vicar of Embleton, Northumberland, before becoming the first Dixie professor of ecclesiastical history at Cambridge. He was appointed to the bishoprics of Peterborough and London in 1891 and 1896 respectively. For five years he edited the *English Historical Review*, and upon the organization of the Church Historical Society was chosen president. His chief works are *History of the Papacy during the Reformation Period*, 5 vols., 1882-97, and *History of the Papacy from the Great Schism to the Sack of Rome*, 6 vols., 1897. He died Jan. 14, 1901.

CREIGHTON UNIVERSITY, at Omaha, Neb., the first free Catholic college in the United States, founded in 1878 by a bequest of Mary L. Creighton. It is under the direction of the Jesuit Fathers and is

coeducational. There are now a preparatory school, colleges of liberal arts, law, medicine, pharmacy and dentistry, a commercial and a summer school, besides extension and teachers' courses. The Medical College maintains a free dispensary. The university's productive funds total \$4,000,000. In 1930 the student enrollment was 2,960, and the faculty of 216 was headed by Pres. WILLIAM AGNEW.

CRÉMAZIE, OCTAVE (1827-79), Canadian poet, was born at Quebec, Apr. 16, 1827. He became an ardent scholar, and worked for the preservation of French Canadian folklore. Because of financial difficulties he went to Paris, where he lived in poverty under the name "Jules Fontaines." He published the journal, *Siège de Paris*, and his *Oeuvres Complètes* appeared in 1883.

CREMER, JAKOBUS JAN (1827-80), Dutch novelist and dramatist, was born at Arnheim, Sept. 11, 1827. He started his career as a painter, but, turning to literature, wrote a masterly series of tales entitled *Stories of Betuwe* that gained him considerable renown. These, as well as his many works of fiction, are characterized by a simplicity, acuteness of observation, and quiet humor that have often led to a comparison with CHARLES DICKENS. Some of Cremer's better known novels are *Judge Joseph*, *Daniel-Sils*, *Anna Rooze*, 1867, and *Dr. Helmond*, 1870. Noteworthy also are his dramatic works and a collection of verse in dialect, entitled *Poems*, 1873. Cremer died at The Hague, June 5, 1880. His collected works in 12 volumes appeared in 1887-88.

CREMONA, a city of north central Italy, capital of the province of the same name, situated on the Po River and surrounded by old walls and four city gates. The fine cathedral was built in Romanesque style, 1107-90, and a marble façade was added in 1491; connected with it by arcades is the Gothic Torazzo, a high clock tower, erected in the 13th century; and nearby is the octagonal baptistery, built in 1167. There are other fine churches of the 15th and 16th centuries, the Gothic Palazzo Pubblico, 1245, and several fine palaces. From the 16th to the 18th century Cremona was the place where famous violins were made by Amati, Guarneri and STRADIVARI. There are diversified local industries, but the most important business is trade in the agricultural products of the fertile vicinity. An important Roman colony in very early times, Cremona later had a checkered career but flourished greatly in the 14th under the rule of Milan. French and Imperial troops fought over it in the 18th century, but the latter held it and it shared the fate of the rest of Lombardy. Pop. 1931, 64,002.

CREOLE CASE, 1841-42, an international issue affecting the slavery controversy in the United States. The brig *Creole*, sailing from Hampton Roads to New Orleans with 130 slaves, had been at sea twenty days when, on Nov. 17, 1841, several of the slaves overpowered the crew, killed one of the officers, and directed the vessel to Nassau, a British port. The authorities at Nassau liberated all the slaves not

directly concerned in the uprising, and held the rest for trial in the local courts. DANIEL WEBSTER, then Secretary of State, demanded the return of all the slaves, as being legal property covered by the United States flag on the high seas. The slaves were never returned. In Congress, Mar. 21, 1842, Representative Joshua R. Giddings presented a set of resolutions defining the anti-slavery view of the issue, declaring that slavery could exist only by edict of a municipality and within its powers of enforcement, and that Virginia law ceased to apply when the *Creole* left Virginia territory. A storm of debate ensued. The House, having a Democratic majority, passed resolutions censuring Giddings, who promptly resigned and was immediately reelected by his constituents.

CREOSOTE, a name applied to a complex mixture of phenols and their ethers, produced in the fractional distillation of wood tar, particularly beechwood tar. It is also applied to a similar product obtained from coal tar. Pure creosote is a colorless oily liquid having a distinctive smoky odor. The usual creosote, however, is colored yellow or brown due to impurities or exposure. Creosote is used as an antiseptic, deodorizer and preservative. Coal tar creosote is valuable as a preservative of timber. The term creosote has been generally applied to a large number of mixtures having properties somewhat similar to the original wood tar product.

CREOSOTE-BUSH (*Larrea tridentata*), a strong-smelling, evergreen shrub of the caltrop family, common in hot arid regions in the southwestern United States and northern Mexico. It grows from 2 to



FROM JEPSON MAN. FL. PLANTS CALIF. COPYRIGHT

CREOSOTE-BUSH

Flower, flowering branchlet, and fruit

12 ft. high, with much branched, brittle stems, and small, very resinous, olive-green leaves. In early spring it blooms profusely, bearing bright yellow flowers and roundish, white-woolly seed-pods. Over wide areas in the Gila, Mohave and Colorado deserts

the creosote-bush is exceedingly abundant, forming a characteristic scrub vegetation known as the "Larrea belt." A reddish-brown lac, deposited on the branches by a small scale-insect, is used for dyeing leather in Mexico, where the plant is also widely employed in household medicine.

CRESCAS, HASDAI (1340-1410), prominent Jewish Talmudist and philosopher of religion, was born at Barcelona, Spain, in 1340. At a late period in the course of his life he settled in Saragossa, where he served as rabbi for many years. Crescas stood in close relations to the court of King Juan I of Aragon, and was frequently consulted on important state matters. In 1396, in order to stem the rising tide of rationalism and to defend Judaism, he wrote, in Spanish, a polemical treatise called *Refutation of the Principal Doctrines of the Christians*, in which he demonstrated the untenability of the Christian articles of faith. It was translated into Hebrew by Joseph ibn Shemtob.

His other important work was the *Or Adonai*, or *The Light of God*, a religious philosophical treatise in which he opposed the teachings of MOSES MAIMONIDES and the philosophy of ARISTOTLE. It was written in 1410, the year of his death, and was published in Ferrara, Italy, in 1556. In writing this work Crescas had the avowed purpose of defending the principles of Orthodox Judaism against the doctrines both of Maimonides and of the other liberal thinkers and rationalists. He attempted to demonstrate that the Aristotelian doctrines which Maimonides had adopted were not at all valid. He believed in the miracles, and declared that eternal bliss was the goal of human existence. Crescas intended this work as a complete guide to the study of the Talmud, and originally conceived it on a grand scale; but only the philosophical section was completed at the time of his death. Nevertheless he was the first religious philosopher to distinguish between universal religion and the specific forms of religion such as those represented by Christianity and Judaism. A. Sh.

BIBLIOGRAPHY.—Husik, *A History of Medieval Jewish Philosophy*, 1916; Graetz, *History of the Jews*, 1926; H. A. Wolfson, *Crescas' Critique of Aristotle*, 1929.

CRESCENDO, an Italian term used in musical EXPRESSION to indicate an increase of tonal volume or loudness. It is often indicated by the sign < and contracted to *cresc.* The crescendo pedal is to be distinguished from the swell pedal in the organ in that the former increases the volume by bringing an increasing number of stops into play, whereas the swell pedal merely opens a set of shutters thereby releasing the tone confined in the swell box.

CRESOL, a liquid, $C_6H_4(CH_3)OH$, having a phenol-like odor, containing a mixture of three isomeric phenols occurring in the tar obtained by destructive distillation of coal, pine and beechwood, but free from phenol, hydrocarbons and water.

Cresol is composed of the following: *Ortho-cresol*, is a crystalline solid melting at 30° C. and boiling at 190.8° C. It may be separated from crude cresol by

fractional distillation, and may be prepared by the fusion of ortho-toluene-sulphonic acid with potash. *Meta-cresol* is a liquid above 4°C. It boils at 202.8°C. It is prepared by heating thymol (para-isopropyl-meta-cresol) with phosphoric oxide. *Para-cresol* is a crystalline solid, melting at 36°C. and boiling at 201.8°C. Para-cresol may be prepared by the fusion of para-toluene-sulphonic acid with potash.

Cresol is soluble in water and miscible in all proportions with alcohol, ether, and glycerine. It is an active poison resembling phenol but possessing a germicidal power about four times as great as that of phenol. It is used chiefly in mixture with equal part of a solution of soft soap as Compound Solution of Cresol U.S.P., as a disinfectant of the skin and as a general antiseptic.

CRESS, a name applied to the pleasantly pungent herbage of various plants of the MUSTARD family used for salad. Among the best known are the garden cress (*Lepidium sativum*), called also PEPPERGRASS, extensively cultivated, especially in Europe; the water cress (*Nasturtium officinale*), widespread in cool running streams and often cultivated, and the winter cress (*Barbarea vulgaris*), a native of Europe and widely naturalized in North America, sparingly grown as a salad plant and marketed as upland cress. Numerous related plants are known as cress, especially various species of *Cardamine*, *Dentaria* and *Arabis*. See also WATER CRESS.

CRESSIDA, according to late poets the faithless love of TROILUS, the son of HECUBA and PRIAM. Classical mythology does not tell this story.

CRESTON, a city in southwestern Iowa, the county seat of Union Co., situated 75 mi. southwest of Des Moines. The Burlington Railroad serves the city. Creston is a livestock shipping point for a wide area. The city has railroad repair shops and stock yards. It is on the summit of the watershed, between the basins of the Missouri and Mississippi rivers. Creston was founded in 1869 as a suitable location for railroad shops. Pop. 1920, 8,034; 1930, 8,615.

CRETACEOUS PERIOD, the fourth subdivision of the MESOZOIC ERA of geological history. If the Comanchean is considered the lower Cretaceous, then the present subject becomes the upper Cretaceous. The name comes from the Latin for CHALK, and has reference to large deposits of that substance formed in the Cretaceous.

CRETAN, MINOAN OR AEGEAN ARCHITECTURE. This architecture is a phase of the art which developed in Crete during the importance of the island as a maritime power. Crete was a younger and brilliant contemporary of Egypt and Mesopotamia, having contacts particularly with Egypt; but a considerable number of ruins on the mainland of Greece and in western Anatolia remain to show that the political and artistic influence of Crete was exerted in that direction.

Important Periods. The dating is relative rather than exact, being based on comparative studies: To 3000 B.C., Stone Age, not properly Minoan. Typical

Neolithic productions are found on Minoan sites. 3000-2200 B.C., Bronze Age, Early Minoan (subdivisions I, II, III). Formative period in Crete. 2200-1600 B.C., Bronze Age. Middle Minoan (subdivisions I, II, III). First period of bloom in Crete, Knossos, Phaestos. 1600-1400 B.C., Bronze Age, Late Minoan (subdivisions I, II, II). Period of continued achievement terminated by the catastrophe which overcame the power of Knossos and the island civilization. 1400-1100 B.C., Bronze Age, Mycenaean. Great period of the derivative civilization in the north, modified by the indigenous peoples and by the Helladic invaders; centering at Mycenae and Troy; terminated by new invasions from farther north. 1100-850 B.C., Iron Age, Greek Dark Ages. Period of formation of Greek Archaic art, partly on the basis of the Mycenaean.

Types of Building. Minoan and Mycenaean architecture was characterized by a freedom rarely found in the more ancient styles, although the less monumental Egyptian work sometimes had the cheerful spirit so typical of Crete. The architects expressed their lively cast of mind by their choice of picturesque sites and layouts; by their lucid composition of large ensembles involving numerous elements and varying levels; by their sureness and ease in the handling of decoration and detail. Their work has an unmistakable independence.

Residential Architecture. By far the most important group of buildings was the residential. The Cretans and Mycenaeans lived in cities, and excavations have revealed great numbers of modest houses as well as more pretentious dwellings of several stories. The houses were made up of rectangular elements and built adjoining one another on narrow streets. The house fronts seem to have been simple, cut through by heavy window-frames and faced with gypsum slabs. The roofs were certainly flat in Crete; some at least were sloping in the northern region. The larger houses had porticoes, gardens and pavilions as adjuncts. Floors and courts in the best work were covered with gypsum or stone slabs.

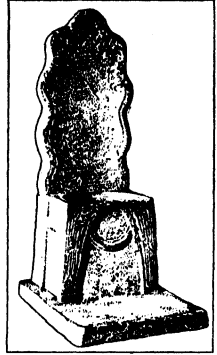
The Cretan and Mycenaean rulers were priest-kings. The palaces contained sanctuaries, were doubtless considered sacred, and so became easily the most splendid type of building. The palaces in Crete were fortified and provided with exterior plazas and monumental stepped theatrical areas for ceremonies. The building groups were arranged about a large paved central courtyard, which from early times was porticoed. The main elements of building tended to group themselves on opposite sides of the court in two principal divisions, one of which contained store and guard rooms, the lustral chamber, and large pillared ceremonial or official apartments, while the other contained the royal private apartments, baths and their dependencies. These elements were disposed in several stories, and combined in the freest possible way by means of smaller courts, porticoes, corridors, stairways and light wells as required for a highly organized mode of life, e.g., Knossos, the largest, and Phaestos. The main-

land palaces were smaller, more heavily fortified, and might have a succession of courts leading to the pillared principal apartment, the *megaron*, which was provided with a portico, a vestibule, and a hearth, all under a pitch roof on the axis of the *megaron* as at Tiryns. These palaces, in which the action of the poems of Homer is set, were considered legendary until the excavations of Schliemann in the 19th century. The elder civilization, of which echoes are heard in Homer, came to light through the work of Sir Arthur Evans at Knossos, beginning in 1900.

Tombs. The monumental Minoan and Mycenaean tomb is a subterranean and circular one, built of horizontal courses of cut stone forming a chamber shaped like a beehive. Beehive tombs abound on the island; but the finest example is at Mycenae. The so-called Treasury of Atreus or Tomb of Agamemnon there has the usual long *dromos*, or approach, cut into the hill; a great linteled doorway surmounted by a mitered arch and once decorated by relief work and columns, leads into the beehive chamber, which was studded with decorative bronze rosettes and provided with a rectangular sidechamber. An elaborate temple tomb, with court, pavilion and a two-storied shrine, has recently been excavated near Knossos.

Civil Architecture. City gates at Tiryns; the famous Lion Gate at Mycenae, so named from the subject of a beautiful limestone relief above the lintel and beneath a triangular corbeled opening; bridges at Mycenae and Knossos; roads traced in Crete; a well-house, and an inn at Knossos survive more or less complete as evidences of secular construction.

Materials and Structure. In engineering work the walls were of good masonry, the blocks being square, oblong, or polygonal, and often large. In this type of work the corbel vault was effectively used. Ordinary walls were of poor rubble set in clay, bonded by timbers and faced with stucco, often gypsum plaques in Crete. Independent supports sometimes took the form of square or rectangular stone piers; sometimes they were wooden columns set on stone bases, the most characteristic of these columns being smaller at the bottom than at the top, where a capital made up of *astragal*, *scotia*, *torus* and *abacus* was set. Such columns, beautifully carved in stone, were used as decorations on the façades of Mycenaean tombs. In the dwellings the joists, door and window frames, and bonding strips were of wood, and were built into the masonry in a way which is not approved in modern practice. The palace at Knossos had a



COURTESY M. M. OF ART

THRONE FROM THE PALACE AT
KNOSSOS, CRETE
About 1500-1350 B.C.

remarkable drainage system. Stone benches are found applied to the walls of many of the apartments in Cretan palaces; but otherwise little remains of their furniture.

Decoration. Stuccoed surfaces were often decorated gaily in fresco. Bright earthen colors were used. There were occasional unsuccessful attempts at large compositions; but the frescoes in general have episodic subjects, lively designs in which human figures as well as a real and fancied flora and fauna appeared, including many motives from the sea. Sometimes the stuccoed surface was modeled in bas-relief. The Minoans made beautiful reliefs in stone and bronze to be employed as architectural decoration. K. C.

BIBLIOGRAPHY.—H. R. Hall, *Aegean Archaeology*, 1915; Sir A. Evans, *The Palace of Minos*, 3 vols., 1921, 1928, 1930; E. Bell, *Prehellenic Architecture in the Aegean*, 1926; W. J. Anderson and R. P. Spiers, rev. W. B. Dinsmoor, *The Architecture of Ancient Greece*, 1927.

CRETE, an island of Greece in the eastern Mediterranean. It is 160 mi. long and from 7 to 35 mi. wide, embracing an area of 3,520 sq. mi. and one of the largest of the Mediterranean islands. At places the land rises from the water in precipitous rocky slopes, affording few harbors on an irregular coast. The only harbor offering adequate facilities to large vessels is Suda, in the northwestern part. The interior of Crete is very mountainous, some of the peaks rising to heights of from 7,000 to 8,000 ft. Mt. Stavros in the center is the loftiest peak and attains a height of 8,193 ft. above sea level. Between the mountains are narrow valleys and plains which are noted for their fertility. The foothills are covered with olive, lemon and orange groves. The growing of olives is, in fact, the principal source of wealth to Crete. Other fruits, especially quinces, apples, pears and mulberries, are grown in abundance. The grape vine is extensively cultivated and there are many tobacco plantations. The main industries are the making of soap and the distillation of cognac. Principal exports are olives and olive oil, lemons and oranges, wine, cognac, dried raisins and soap. The largest cities of the island are CANDIA and CANEA, whose respective populations in 1928 were 33,404 and 25,604.

In classical times Crete was filled with flourishing cities and to-day represents a rich treasure of archaeological discoveries. Crete became a Roman possession in the 1st century B.C. The Venetians made themselves its masters in 1204 and held it till 1669, when the Turks completed their conquest of the island. In 1898 a general rebellion by the inhabitants against the domination of Turkey resulted in the establishment by the powers of an autonomous Cretan government, under the suzerainty of Turkey. Greece, however, annexed the island during the Balkan War in 1912, and ever since it has been a province of the Greek State. Pop. 1928, 386,447.

CRETINISM, a mental and physical defect in childhood occurring sporadically everywhere, but chiefly in areas such as the Alps and Himalayas where goiter is abundant. It is rare in the more lightly affected

goiter regions of the United States. The thyroid gland is either undeveloped or goiterous. (See **THYROID GLAND**.) In either case the symptoms are probably dependent upon its inability to form the normal secretion or hormone in adequate amounts, although this is disputed by some as the complete explanation of the sporadic type. The disability usually appears during the first year of life. Growth is stunted and the long bones are often abnormally curved. The low slanting brow, high cheek bones, squat nose, narrow oblique eyes, swollen lips and tongue, together with the stupid expression, give the face a characteristic appearance. The skin is everywhere thickened and dry, the hair sparse, coarse and lusterless, the teeth delayed and imperfect. The abdomen is commonly prominent. Sexual maturity is inhibited or delayed. Intelligence is always impaired, imbecility being common. Severe cases rarely live long, but adult and even elderly cretins of less degree are frequently found in Alpine villages. Feeding of dried thyroid gland brings spectacular improvement in favorable cases, but is often disappointing, especially if the disease be of long standing. Prevention of goiter by the administration of iodine, which while necessary to the normal functioning of the thyroid gland is often deficient in the soils and waters of goiter areas, is a measure of great importance in the prevention of cretinism.

R. GR.

CREUSA. 1. The daughter of HECUBA and PRIAM, King of Troy. She was the wife of AENEAS and the mother of Ascanius. 2. The wife of JASON and daughter of Creon of Corinth. She was burned to death by Medea's (see **MEDEA**) bridal gifts of diadem and robe.

CREVASSE. The brittle ice of glaciers, moving more rapidly in the center than at the sides, becomes crisscrossed with gaping cracks called crevasses, caused by unequal strains. Transverse fissures open



FROM AMER. MUS. OF NATL. HISTORY PHOTO

"THE JUNCTION," A CREVASSE IN FRANCE

where the ice-stream passes over sudden gradients in its bed. Diagonal splits occur along the margin, where the ice drags against irregularities in its gorge. Widened and deepened by melting, crevasses yawn from a few feet to 50 in width and go down sometimes 100 to 300 ft. When masked or bridged by

impacted snow, crevasses make glacier exploration extremely hazardous.

CREWE, a municipal borough of Cheshire, England, and a great railway junction of northern Great Britain, about 43 mi. southeast of Liverpool. Less than a century ago a single farmhouse in open country stood on the site, but since 1842 and the advent of the railways, Crewe has grown rapidly. Old Oak Farm, 1639, the original farmstead, still survives, surrounded by modern structures. To-day Crewe, largely inhabited by railway employees, has splendid public buildings, parks and an enormous locomotive works. Pop. 1921, 46,497; 1931, 46,061.

CRIBBAGE, a game of cards for two, three or four players. A full pack and a cribbage board for scoring are used. The board has 60 holes for every player and a game hole at each end. When three play, a triangular board is used. When four play, there are two sets of partners, one partner scoring for both. When two play, each is dealt five or six cards, and each puts two cards of his hand into the crib. With three players, five cards are dealt, one from each hand going to the crib, together with an extra card from the pack. When four play, five cards are dealt, one card from each hand going to the crib.

Usually the game is played by two people, with six-card hands. The rest of the pack is placed face down on the table. The players place two cards in the crib at the end of the board nearest the dealer, and the pack is then cut by the non-dealer, the dealer turning up the top card. If it is a Jack, he counts "two for his nubs." The non-dealer then plays a card face up on his side of the board, and the dealer follows, adding the face value of the two cards and announcing the total. All face cards count ten. The non-dealer then plays a card, announcing the total of the three. This continues as long as neither player goes over 31. If a player hits 31 exactly, he scores two points; if he cannot play without going over 31, his opponent scores one point for a go. Other counts are fifteen, pairs, sequences and flushes. After the hand has been played each picks up and counts his cards, and the dealer counts any points in the crib. The value of the various counts will be found in *Hoyle's Games*.

CRICCIETH, a watering-place of Carnarvonshire, Wales, lying on Cardigan Bay about 203 mi. northwest of London. In it lie the gaunt ruins of a castle, apparently of British origin, which top a rocky eminence projecting into the sea. Across the bay is Harlech and the Merionethshire hills. The home of David Lloyd George lies behind Criccieth, and he attended school at Llanystumdwy, about two miles distant. Criccieth is the center of a resort and has good golf links and excellent sea-bathing. Pop. 1921, 1,886; 1931, 1,449.

CRICKET, any member of the family *Gryllidae*. The males usually have the fore-wings modified to form musical organs; the females usually possess a long ovipositor. Most crickets have powerful hind legs adapted for leaping. They may be either winged or wingless.

Field crickets are common everywhere in meadows, pastures and gardens. Some even enter our dwellings. The eggs of most species are laid in autumn, in the ground, hatching the following summer. While some are predaceous, the majority feed upon plants.

Sword-bearing crickets are small forms, living on tall weeds growing in or near water. The ovipositor of the female is sword-shaped. Certain very small crickets live as guests in the nests of ants, and are known as ant-loving crickets. They feed on an oily secretion on the bodies of the ants.

Tree crickets are delicate, light green insects living in trees or tall plants. The snowy tree cricket is the most familiar. In late summer and autumn these insects continue their rhythmical, high-pitched singing throughout the night. They are more often heard than seen. Another species of tree cricket lays its eggs in raspberry canes, sometimes causing considerable injury.

Mole crickets differ considerably in appearance from all other members of the family. Their powerful fore legs are much broadened and fitted for digging. Each leg terminates in strong, blade-like teeth. The hind legs are not well fitted for jumping, nor is the ovipositor of the female visible. These crickets sometimes damage grass and grains by cutting the roots. J. R. T.

CRICKET, the British national sport, played on a greensward by two teams, which consist of 11 players on a side. The wickets, consisting of three stumps 27 inches high with two horizontals, or *bails*, placed across the top, are erected 22 yards apart. The bat is 36 inches in length, and the cricket-ball weighs 5½ ounces. At the start of the game, the field side, or outs, take their positions at points convenient to stopping or catching the ball. These field positions are designated as bowler, wicket-keeper, long-stop, short-slip, point, long-slip, long-on, long-off, cover-point, mid-wicket on, and leg. The opposing side posts batsmen at each wicket. The bowler throws the ball at the wicket, attempting to strike it. The batsman strives to protect the wicket by stopping the ball or hitting it afield, in which event the two batsmen exchange positions as many times as possible before the ball is fielded in. After six balls, the umpire calls "over," and the bowler hurls to the other batsman. A batsman is called out if the bowler's ball strikes the wicket; if he "flies out," as in baseball; or if the fielded ball is thrown in and strikes the wickets. The batsmen may add to their runs if the wicket-keeper fails to stop a ball. When all the players of one side have been declared out, the opposing players come in to take the bat. Outside of England, cricket has an enthusiastic following in Australia, Canada and India. In the United States cricket playing is restricted to a few clubs in the East.

CRICKET ON THE HEARTH, THE, a Christmas story by CHARLES DICKENS; published 1845. Into this tale of the joys of home-life is woven the love story of Edward, son of Caleb Plummer, an old toy-maker, and his sweetheart, May Fielding, who is

saved from a disastrous marriage with a toy-merchant by Caleb's timely homecoming from South America. The singing match between a kettle and a cricket on the cosy hearth of Dot Perrybingle suggest the title of this charming tale.

CRILE, GEORGE WASHINGTON (1864-), American surgeon, was born in Chili, Ohio, Nov. 11, 1864. He graduated from Northern University in 1884. Following this he took a medical course at Wooster University, Cleveland, Ohio (which is now Western Reserve), receiving his M.D. degree in 1887. He pursued his post-graduate studies further in the medical universities of Europe in 1893, 1895 and 1898. In the meantime Dr. Crile was on the faculty of Wooster University as lecturer on histology (1889-90), professor of physiology (1890-93), and professor of the principles and practice of surgery (1893-1900). He continued on the faculty of the university when it was reorganized as the Western Reserve University, being professor of clinical surgery (1900-11) and professor of surgery (1911-24). Dr. Crile was also visiting surgeon of the Lakeside Hospital, Cleveland (1911-24) and was one of the founders of the Cleveland Clinic Foundation. He served in the Spanish-American War as surgeon in Cuba and Porto Rico (1898) and also in the World War with the Medical Officers Reserve Corps. He was professional director of U.S.A. Base Hospital No. 4 in France and in 1921 became brigadier general of the Medical Officers Reserve Corps. He was awarded by Congress the Distinguished Service Medal and received other decorations and high honors from the European governments and societies, among them being that of Chevalier of the Legion of Honor of France. Dr. Crile is especially noted for his work on surgical shock and for his invention of the method of anoci-association in connection with anesthesia to prevent shock in surgical operations. He is author of a number of medical works, among them being *Surgical Shock*, 1897; *Hemorrhage and Transfusion*, 1909; *Anoci-Association*, 1914 (with W. E. Lower), published in the 1920 edition under the title of *Surgical Shock and the Shockless Operation through Anoci-Association; A Physical Interpretation of Exhaustion and Restoration*, 1921; *Problems of Surgery*, 1928.

CRIME, a violation of the social codes of a community punishable by law, generally by physical pain or segregation. Immorality is also antisocial, but its punishment and control are left to public opinion. (See also SIN.) The categories shift with changes in culture. In primitive times slander was a crime, today it is a TORT.

Crime has been called the most important public issue in the United States, where students estimate the annual cost somewhere between \$10,000,000,000 and \$15,000,000,000. United States estimates put the age of maximum tendency towards criminality between 18 and 22. This is due in part to the increase of youthful loafing, in part to greater social impulses to criminality and in part to the rise of criminal GANGS.

In that country males in penal institutions outnumber

ber females by nine or ten to one. This does not mean that men are inherently more criminal than women. Women turn to PROSTITUTION, and often act as concealed confederates of male criminals, and hence are not detected, arrested and convicted. Further, it is harder to convict a woman before a JURY of men. The percentage of female criminality is, however, increasing. There is the least amount of crime in open country areas, and the most, unexplainably, in towns of from 2,000-4,000. Intermediate in criminality come the larger cities, the volume of crime varying directly with the size of the city. The foreign-born show a two to one greater frequency in convictions than native-born whites in the United States, but this is explained in part by the fact that foreign-born settle mainly in cities where the crime rate is high. Most of them are adults and in the maximum crime-age levels, and they are usually more under suspicion by the police and less able to get clever lawyers to defend them.

Negroes show a far higher crime rate than whites, but this is no doubt due to cultural handicaps, legal discrimination, inadequate defense and similar causes. There is no evidence that race alone accounts for the higher negro crime rate.

Prior to the army mental tests, it was believed that FEEBLE-MINDEDNESS was far more prevalent among convicts than among the law-abiding. The army tests (see TESTS, PSYCHOLOGICAL) and the studies of Murchinson, Root and others have proved that such a conception is an illusion. Even the convicts—the stupid and unlucky minority of the criminal class—appear to be fully as intelligent as the law-abiding majority of men. Among the more serious types of criminals, however, feeble-mindedness is far more frequent than among the population at large. A number of careful studies of convict populations indicate that about 25% of convicts are feeble-minded; another 25% neurotic (see NEURASTHENIA) and psychotic (see PSYCHIATRY); and about 50% the victims of poverty, evil associations, vicious habits and other environmental causes. There is a slightly greater degree of ILLITERACY among criminals, but it cannot be shown that illiteracy is a direct cause of criminality, rather only a part of the general environmental handicaps of the criminals.

Chronic alcoholism and DRUG ADDICTION are prevalent among convicts, but the addiction to the drugs is the result of the general neurotic condition, which, if anything, is the cause of the criminality. Before the passage of the Harrison Antinarcotic Act, drug addicts furnished far less than their proportionate share of criminals. Prohibition legislation and antinarcotic laws have brought about a condition in which alcohol and drugs may be regarded as major causes of crime in contemporary America, but many claim this responsibility may be traced to the laws rather than to alcohol or narcotics. The same may be said of prostitution.

The repression of crime in the United States has been very ineffective for several reasons. The police

are often not selected on the basis of intelligence or technical training. Relatively few criminals are arrested. The court system is defective. The magistrate's courts which try most MISDEMEANORS, are sometimes manned by relatively untrained and incompetent judges with no knowledge of criminal science. The dockets are frightfully overcrowded, so that no real attention can be given to any case. The procedure in the higher courts is gravely reduced in efficiency by the outgrown jury system, which should be replaced by a permanent board of examining experts. Moreover, there is much actual corruption of the courts, resulting in the sale of justice.

The first types of punishment consisted in corporal punishment or in exile. Corporal punishment—flogging, whipping, mutilation and branding—persisted until the 19th century. During the last century and a half imprisonment has been the most popular type of punishment for crime. In maintaining PRISON discipline many of the older forms of corporal punishment have been retained. Transportation of criminals to penal colonies was employed extensively in the 18th and 19th centuries; and is still utilized by France and Italy.

A late development has been the abandonment in scientific circles of the old goal of finding a punishment to fit a particular crime. The aim now is to select the appropriate treatment to fit the needs of the individual criminal. H. E. B.

BIBLIOGRAPHY.—F. H. Wines, *Punishment and Reformation*, 1919; J. H. Gillin, *Criminology and Penology*, 1926; P. A. Parsons, *Crime and the Criminal*, 1926; H. E. Barnes, *The Story of Punishment*, 1930.

CRIME, ORGANIZED, crime carried on by organized groups of criminals, usually with the protection of law enforcement officers, and mainly concerned with the conduct of illegitimate business. Its success is largely dependent on the state of public opinion. Some criminal organizations are effected for the commission of robberies of furs, banks, mail trains and jewelry, for kidnapping, extortion, automobile thefts and fraud, but most organizations direct their efforts toward liquor, gambling and prostitution. In legitimate business, the control of wages and prices through violence (racketeering) has been an important activity in some areas.

In the United States the business of supplying liquor assumes a great responsibility for organized crime. The operation of organized gangs in gambling and prostitution has been traced in its modern form to as far back as 1900, but it was not until the advent of PROHIBITION that the highly lucrative rewards became known. Bootlegging is the term which embraces the several activities of smuggling and transporting liquor, of manufacturing it illegally, of selling it to the public through cabarets and camouflaged retail establishments (speakeasies), and of delivering it directly to the consumer. While these activities are in themselves violations of the law, they do not arouse public sentiment against them to such an extent as do other incidental activities.

Control of illicit business is lodged with the gang and is usually effected by means of violence. A gang may attain control by shooting or kidnapping and killing (taking for a ride) members of enemy gangs, by stealing liquor in transport (hijacking), and by threatening the lives and bombing the establishments of those who refuse to sell liquor supplied by the gang. With the enormous profits of bootlegging, prostitution and gambling, the gangster is often able to buy protection from government officers.

This alliance between crime and politics is found to rest not alone upon bribery, but also upon the spoils of office. Criminal gangs are able to render signal service to candidates for office through intimidation of opponents, as well as through stealing ballots, falsifying election returns, voting as repeaters and kidnapping and assaulting election workers and officials. In return they may be granted immunity from interference in the operation of gambling houses, vice resorts and liquor establishments. Moreover, through alliances of this sort and with the aid of perjury and purchase and intimidation of witnesses and jurors, criminal gangsters when brought into court are strikingly successful in escaping punishment for the operation of their businesses and for the incidental crimes of murder, bombing and kidnapping. In this they have the assistance of lawyers and bondsmen whose occupations pursued even in legitimate fashion are of infinite aid to criminal enterprises.

Similar to the unscrupulous lawyer in his relation to crime is the fence, a pawnbroker who accepts stolen property and disposes of it to legitimate dealers. The large booty of fur and jewelry robberies would be of little value to the criminal were he unable to dispose of it through channels which do not attract attention to himself.

The extreme ramification of the activities of illicit business call for large organizations and highly specialized occupations. The leaders are somewhat of the nature of ENTREPRENEURS providing the capital outlay, organizing and directing the gang and meeting the representatives of legal society. The lieutenants perform the services of body-guards to the chief, and through their ability as sluggers and killers maintain and extend the territory of the gang. In addition, there are the bar tenders, the beer-runners, the machine gun experts, the bombers, the "alky cooks" and the brewers. The skills of gambling and prostitution are as great.

The impression that organized crime is in the hands of the foreign-born is largely erroneous. Gangsters are usually nurtured in the slum areas, which are largely inhabited by first and second generation immigrants, and where politically-licensed disregard of the law and the unconscious policy of civic noninterference have been favorable to gang life. In their quest for large profits, gangsters turned to racketeering, which is the exploitation by means of violence of a business association or an employees' organization. A racketeer may be or pretend to be the boss of a supposedly legitimate business association or a labor

union organizer. By means of intimidation and violence he is able to control prices, the location of shops, the number of persons engaged in an occupation and the wages paid. In return he collects tribute in the form of dues and fines. Racketeering has been used by men in small legitimate business as a means of circumventing the provision of the Sherman Antitrust Act regulating competition in restraint of trade.

C. T.

BIBLIOGRAPHY.—Illinois Association for Criminal Justice, *The Illinois Crime Survey*, 1929.

CRIMEA. The Tauric Peninsula, or Crimea, with an area of 15,697 sq. mi., is connected by the isthmus of Perekop with the mainland of southern Russia, from which it is separated, to the northeast by the Sea of Azov and to the northwest by the Black Sea. Its northern section is a treeless plain, rising southward toward the wooded Yaila range, which occupies the whole southern section of the peninsula. The southern slope, enjoying ample rainfall and a mild climate, is a noted resort area, frequently termed the Russian Riviera. Originally inhabited by the barbaric Taurians, the Crimea was colonized by the Greeks as early as the 6th century B.C. It became a Roman vassal state under Augustus. A considerable Gothic settlement ensued during the period of migrations. Genoese and Venetian traders frequented its mediaeval harbors. After its occupation by the Tatars, it remained in their hands (from 1478 under Turkish sovereignty) until 1783, when the peninsula became a Russian province. In 1854-55, Sebastopol, the chief south-Russian naval base, situated at the western extremity of the peninsula, was the scene of a Franco-British siege of 349 days' duration, which culminated in the French capture of the Mala Khov Hill and the evacuation of the Russian garrison.

CRIME AND PUNISHMENT, a novel of crime and abnormal psychology by FEODOR DOSTOIEVSKI (published 1866; English translation by Constance Garnett, 1911). This is the profoundly analytical story of an impoverished young student, Raskolnikov, who murders a pawnbroker—a parasitic, grasping hag—finding his justification in his intellectual theories. With relentless insight and care, the author traces every step in the mind of Raskolnikov before, during and after the crime, developing the theme on a magnificent scale until at last his hero finds atonement and pardon through fellowship and love. Gloomy, unmitigated in its depiction of character, it is perhaps Dostoievski's most representative work.

CRIMEAN REPUBLIC, an autonomous Socialist Soviet Republic in a peninsula on the north side of the Black Sea. Area 16,109 sq. mi. On the west and south it is bounded by the Black Sea, on the east by the Sea of Azov. Three-fourths of the republic belong to the region of steppes, but the other part, stretching along the coast from west to east, abounds in beautiful mountain scenery. Here the valleys looking southward are luxuriant with vines, olives and mulberry plantations, while the northern slope gives a large yield in cereals. Tobacco, flax and hemp are

important productions. The climate is unequal, and in winter is severe. The chief rivers are the Saighir, Tchernaya and Alma.

The country was anciently associated with the Cimmerians, and in later times with various Greek settlements, minor kingdoms and with the Mongols. In 1758 the Russians took possession of the country; and with the view of overawing the Turks, the great naval seaport of SEBASTOPOL, occupying a commanding position in the Black Sea, was begun by Catharine II in 1786. Military resources were steadily developed up to the time of the Anglo-French campaign of 1854, when part of the country was occupied by the allies. The republic was formed by decree in 1921. Simferopol, with a population of 80,719, is the capital. Pop. 1926, 700,027.

CRIMEAN WAR, the conflict during 1853-56 between Turkey, Great Britain, France and Sardinia on one side, and Russia on the other. It arose out of the ambition of Czar Nicholas I to extend his influence over Constantinople. The war had its immediate origin in a Turkish dispute between the Latin and the Greek churches, the first protected by Catholic France, the second supported by orthodox Russia. In 1852, after complicated negotiations, the Porte ruled in favor of the Latin church on the comparatively trivial issue of the protection of holy shrines in Palestine. The larger issue was the growing Russian influence about Constantinople which threatened the British overland route to India. Russia delivered an ultimatum to the Porte in May, 1853, and advanced into the Turkish principalities in the Balkans. Turkey declared war against Russia on Oct. 23, 1853, and was joined by France on Oct. 27, by England on Mar. 28, 1854, and by Sardinia on Jan. 26, 1855. In the face of this formidable coalition and a hostile Austria on his right flank, the Czar retreated from the Danube, while the combined British and French fleets moved into the Black Sea to Varna. Finding the Russian forces had been withdrawn, they proceeded to the Crimean peninsula. Troops landed Sept. 16, 1854, and began the siege of Sebastopol. After a series of operations costly to both sides, among them the *Charge of the Light Brigade*, the Russians fired Sebastopol and evacuated it. The Allies entered on Sept. 8, 1855. The **TREATY OF PARIS**, signed on Mar. 30, 1856, terminated the war. By it the independence of Turkey was maintained, Russia was to abandon her interference in the Danubian territories; the Sultan agreed to certain reforms; the Danube was made a stream navigable for all nations; and the Black Sea was declared open to commercial ships of all nations.

CRIME OF '73, a phrase current in political campaigns in which **BIMETALISM** was an issue, opprobriously characterizing an act of Congress, 1873, which revised the laws relative to the mint and coinage. The act omitted the standard silver dollar of 412½ grains from the list of coins; the only silver coin provided was a special dollar for Oriental trade. The demonetization of silver created no comment at

the time. The panic of 1873 occasioned a demand for an inflated currency. Subsequent partisan discussions charged that the omission of silver from the list of 1873 was the result of a conspiracy between eastern bankers and legislators, with intent to cause financial stringency.

CRIME OF SYLVESTRE BONNARD, THE, (*Le Crime de Sylvestre Bonnard*), a novel by Anatole France; published 1881. In the ripeness of his years and wisdom the old savant Sylvestre Bonnard, lives with his reveries among his books. By chance he meets the orphaned daughter of his old love, and is so pleased with the child that he becomes her guardian. His crime consists in delivering his ward from the drudgery of an abominable boarding-school. The book, which won for its author his election to the *Académie Française*, is leavened throughout with a fine, tender irony.

CRIMINAL ANTHROPOLOGY. The study of the physical characteristics of criminals was begun by an Italian, Cesare Lombroso (1836-1909), who in 1876 announced his theory of "instinctive" or "born" criminals, hereditarily stigmatized by certain anatomical anomalies, such as massive protruding jaws, receding foreheads, large brow-ridges, cranial and facial asymmetry, malformed ears, etc. Lombroso maintained that, irrespective of race, combinations of these physical peculiarities were symptomatic of organisms predisposed to anti-social conduct. The hereditary criminal was either a reversion to a primitive physical and mental type of man or a degenerative, pathological product of inferior heredity.

Lombroso's results are to-day generally considered at fault. He failed to study sufficiently large samples of criminals and to check his findings against adequate groups of the "normal" population; statistical methods of allowing for differences due to chance alone had not yet been developed; physical variations due to race were not considered; he utilized many subjective, immensurable observations on anatomical features, which yielded results dependent upon the bias of the investigator. His theories have been discarded by most students of criminology, not only for the above reasons, but also on account of the prevalent belief that the causes of delinquency are to be sought in the environment of the criminal rather than in his heredity, or that crime is a sociological product and not a biological phenomenon. Nevertheless, Lombroso was a pioneer, the first to direct attention to the criminal as an individual.

In 1913 Charles Goring published *The English Convict*, a study of the anthropometric, psychological and sociological characters of some 3,000 prison inmates. His avowed intention was to refute Lombroso's hypothesis of criminal types. This he accomplished by the use of elaborate statistical methods purporting to show that criminals, classified by nature of crime, were undifferentiated physically and indistinguishable from the law-abiding population. His data indicated, however, that English criminals were physically and mentally inferior to non-criminals, and that heredity is

most important in the production of delinquents. Goring, like Lombroso, neglected the important factor of racial differences in his criminals. His bias led him to make frequent use of questionable mathematical devices to establish his contentions.

At present the anthropological status of the criminal is still undefined, and criminological studies are monopolized by sociologists, psychiatrists and jurists. However, one investigation of the physical features of the criminal in the United States was nearing completion in 1931. It comprises data pertaining to 18,000 individuals from ten States, including criminals, the criminal insane and civil insane and check samples of civilians. Its object is to ascertain the relation of nationality and race to crime. Preliminary results show that criminals of the same nationality and race are strongly differentiated in physique according to nature of crime, and that various races differ markedly in their criminal tendencies. No general "criminal types" appear to exist. The allied problem of the relation of constitutional type to mental and physical disease is being investigated actively in Europe and in the United States. E. A. H.

BIBLIOGRAPHY—Havelock Ellis, *The Criminal*, 1913; Charles Goring, *The English Convict*, London, 1913; unpublished results of the *Harvard Anthropological Survey of American Criminals*.

CRIMINAL LAW, one of many means employed by society to control and regulate individual and group conduct. Viewed in this way the types of conduct which are designated as crimes in the law constitute only a relatively small proportion of those acts which society in whole or in part disapproves or in fact penalizes. In seeking for the exact nature of criminal law, therefore, we find it profitable to look not to the entire body of what the sociologist calls antisocial conduct, but to what the specific law, embodied largely in statutes, partly in judicial decisions and to a slight degree in established custom, has declared to be criminal. On this basis, the criminal law is defined in *Black's Law Dictionary* as "that branch or division of law which treats of crimes and their punishments."

An admirable summation of the origins of criminal law is embodied in Roscoe Pound's statement that "the historical origins of the criminal law are in sacrificial execution, in offhand popular vengeance, in patriarchal paternal power, in private self-help, in magisterial discipline, and in legislative justice." A convenient way to understand the more immediate sources of the English and American criminal law is the great English legal doctrine of the King's Peace. The phrase comes from the time when the king's protection was not universal but particular. The King's Peace was the "pledge of his protection," extended to particular times and places or conferred as a favor on particular persons. Breach of it made the wrong-doer the king's enemy. Rapidly, after the Norman Conquest, the King's Peace was extended to all England until it became the general safeguard of public order. This doctrine was part of the heritage of the American colonists. The systems of criminal law and procedure,

set up after the Revolution, were based on this conception of the state as the source of justice.

The French Penal Code of 1810 marked the first important modern attempt to draw into unity the penal laws of a state. No doubt Edward Livingston's model code, drawn for Louisiana not long after, was in form and to some degree in substance, influenced by the French example. The American States were in turn influenced by him and the movement for codification of the penal law spread throughout the states in the century that followed. The need for embodying the criminal law in legislative codes rather than in the COMMON LAW arose from many causes, notably, the fact that social and economic evolution out-ran the slow moving common law and necessity required not only definiteness but a new synthesis of law and life.

In the primitive law there was no question as to mental responsibility. Personal vengeance presumably did not stop to consider intent or responsibility. The accidental character of the act was not an issue. This assumption of a free will, except in the grossest forms of insanity, pervades the criminal law that we have inherited from earlier times. The concept of the *mens rea* (guilty mind) came to be used to provide a distinction between acts accompanied by a state of mind consistent with "guilt" and those which were not. The *mens rea*, according to Stephen "means no more than that the definition of all or nearly all crimes contains not only an outward or visible element, but a mental element, varying according to the different nature of different crimes." The attempts of the law, in the face of the rapid evolution of psychology and morals, to get the *mens rea* within the realm of precise definition has been unsatisfactory. Not only is the general idea of responsibility in great confusion but the particular problem of lack of responsibility on account of insanity is utterly unsatisfactory. The progress of modern psychiatric knowledge seems to call for not only a new test of responsibility, but modern procedural methods for informing the court as to the mental condition of the defendant.

Codification implies classification and in the development of modern codes much emphasis has been placed upon the distinctions among the various crimes. The distinction between a FELONY and a MISDEMEANOR, which grew up largely for historical reasons, provides a convenient means of distinguishing between the more and the less serious offenses. The distinction provides not only a different course of prosecution and adjudication of these offenses, but a different sort of penal treatment in case of conviction.

The law books provide a great many schemes of classifying crimes. In the main, these follow the scheme of WILLIAM BLACKSTONE, which grouped offenses according to the object against which the offense was directed, as, crimes against the person, or against the dwelling-house, or the public morals, etc. This does not provide the means for a useful ordering of offenses in the face of the great multiplication of offenses in recent times, particularly in the United States. Vast numbers of acts formerly left to

the regulation of religion or of public opinion generally are now brought within the criminal law, creating new problems of definition and enforcement.

In the fixing of penalties and of penal treatment, modern life and scientific progress create a new major problem. The older series of penalties were aimed at a hypothetical person who had a free will and who could be controlled, perhaps rehabilitated by suffering and penitence, and who would, because of the danger of consequences, be deterred from crime. But modern thought has enlarged and changed this conception of the individual. Persons differ; they need individualized treatment, psychological and physical. They are not easily deterred by the example of others. Thus, there pervades modern penology the ideas of individual treatment and preventive justice. This conception is slowly changing the character of criminal law.

R. Mo.

BIBLIOGRAPHY.—J. P. Bishop, *Commentaries on the Criminal Law*, 2 vols., 1882; J. F. Stephen, *A History of the Criminal Law of England*, 3 vols., 1883; Roscoe Pound, *Criminal Justice in America*, 1930.

CRIMMITSCHAU, a city in Saxony, on the Pleisse, about 37 mi. south of Leipzig. It has a 16th century church, vocational and other schools, textile and machine factories. Originally a town of the Slavic race of Sorbs, it was mentioned in 1210 and belonged to the lords of Schonburg from 1291 to 1413, when it came to Meissen. Pop. 1925, 27,119.

CRINOID, the name for members of an echinoderm class (*Crinoidea*) which includes the sea lilies and the feather stars. Their more familiar relations are the sea stars and sea urchins.

The crinoids are the most primitive of echinoderms. They are not very common in modern times, although in some regions of the deep sea large numbers may be found, but in former geologic ages they occurred in such vast quantities that thick beds of rock were formed from their skeletons.

Typical crinoids are called sea lilies because their bodies are born on a long stalk, with root-like processes at its base, by which the animal is anchored to the ocean floor. The main part of the body is usually cup-shaped, and from it five arms, which may fork many times, extend upward. Tiny branches, called pinnules, are given off on either side of the arms or their forks, and the whole effect is extraordinarily lovely; the animals look, indeed, like exotic lilies with feathery petals. Canals, or food-grooves, lead along the arms toward the mouth, which is situated in their midst, and faces upward. These canals are lined with lashing cilia, that keep currents of water, bearing microscopic organic matter on which the sea lilies feed, constantly moving in the direction of the mouth.

The sexes are separate, and the eggs or sperm are discharged into the sea. At first the larvae are free-swimming; later they settle down on the bottom and develop into fixed adults. The feather stars (*Comatulida*) differ from the sea lilies chiefly in that, as adults, their ancestral stalks are reduced to negligible

knobs. They are consequently free to move about when necessary. It is interesting to note that during their development the feather stars pass through a sedentary stalked period. *See also* FEATHER STAR.

A. I. W.

CRINUM, a genus of handsome bulbous plants of the *AMARYLLIS* family several of which are cultivated for their beautiful flowers. There are about 100 species native to tropical and subtropical regions. One species, the Florida swamp lily (*C. americanum*), is found in the southern United States. Crinum bulbs, which are often of great size, give rise to strap-shaped or sword-shaped, evergreen basal leaves and a solid flower-stalk bearing a cluster of large, often very fragrant white flowers with reddish markings.

CRIPPLE CREEK, a mining town of Colorado, the county seat of Teller Co., about 40 mi. southwest of Colorado Springs. The district was formerly one of the most productive gold regions in the world. The total output of gold from 1890 to 1930 exceeded \$300,000,000; in 1891 the value was \$1,950; in 1900, the peak year, \$18,199,736. Since 1913 the output has greatly decreased though some of the mines are still productive. The total population of Cripple Creek in the 1900 census was 10,147; in 1920, 2,325; and in 1930, 1,427.

CRISIS, a phase of the major business cycle which immediately follows the boom (*see* BUSINESS CYCLES). It is the period between intense business prosperity and the slower decline of business activity or depression. This turning point from prosperity to depression is called the crisis because it is a period of greatest hazard,—during which practically all business enterprises sustain great losses and many of them fail.

The outstanding characteristic of the crisis is the rapid fall in the wholesale price level, with consequent business losses. The break in the price level brings about a dramatic decrease in available bank CREDIT and a rapid change in the business outlook from optimism to extreme pessimism and timidity. The rapid changes which occur during a business crisis are about as follows.

Confidence in the prevailing high prices is suddenly replaced by belief that prices will decline rapidly. Bankers (*see* BANKS and BANKING) refuse to extend additional loans to business enterprises and demand that old loans be paid off. The pressure for the liquidation of credit and the change in the psychological attitude of the community cause a rapid decline in prices of goods of all kinds. Everybody seems to want to sell and few desire to buy; a surplus of goods in every field appears. Many industries are closed down because of this surplus and declining prices; others operate on part time. Many laborers are thrown out of employment, and others are given part time work only; wages are reduced, but not as rapidly as prices. Prices of securities on the stock market fall rapidly and interest rates rise rapidly. Because of the losses from the price declines, many business enterprises fail and others are placed in insecure financial positions.

The crisis is of comparatively short duration—never more than a few months. The liquidation of many loans and the acceptance of many losses bring about an improvement in the MONEY MARKET. The decline in prices and the liquidation in credit become less rapid and the fear of business men settles down to stolid pessimism. This is the beginning of the period of depression which follows a crisis. The depression is a continuation of the downward movement in prices which may last for a year or so.

The crisis results from the preceding boom; it is brought about by the stresses and strains which develop in the boom movement. In other words, the boom sows the seeds for its own destruction. The boom is brought to an end because the COST OF PRODUCTION begins to rise faster than the prices of products; finished consumers' goods begin to flow to the market faster than the increase in purchasing power of consumers; and bank credit is over-expanded and must be reduced. When the boom comes to an end, the inflated state of prices, the reduction in bank credit, and the change in the psychological attitude make the crisis inevitable. The occurrence of the crisis is the only way to cure industrial society of the unhealthy inflational conditions of the boom.

A. B. A.

BIBLIOGRAPHY.—Arthur B. Adams, *Economics of Business Cycles*.

CRISPI, FRANCESCO (1819-1901), Italian statesman. He was born at Ribera, Sicily, Oct. 4, 1819, and in early manhood practiced as a barrister in Palermo and Naples. He took part in the Sicilian revolt of 1848 and was forced to flee to Piedmont, where he earned his living by journalism. In 1859 he served under Garibaldi in the struggle for the liberation of Italy. A radical and anti-clerical, he entered politics, being representative of Palermo in the new Italian Chamber of Deputies in 1861. He held various positions in the Italian government, was President of the Chamber (1876) and Minister of the Interior, 1877, resigning in 1878. In 1887 he again held the office of Minister of the Interior for a short time and after the death of Depretis became Premier, holding also the portfolio of Foreign Affairs (1887-90). He was again Premier in 1893-96. At first a republican, he later became a monarchist. He was a strong advocate for the Triple Alliance between Italy, Germany and Austria. He died at Naples, Aug. 11, 1901, at the age of eighty-two.

CRISPIN and CRISPINIAN, Christian martyrs and patron saints of shoemakers, whose feast is celebrated in Catholic and Anglican churches on Oct. 25. According to tradition they were brothers of a noble Roman family, who fled to Soissons; here they made many converts and supported themselves by shoemaking. They were put to death by being thrown into a cauldron of melted lead about 286, at the order of Maximian. They were buried at Soissons originally, but their remains were later removed, part being taken to Osnabrück by Charlemagne and part to the chapel of San Lorenzo in Rome.

CRITICAL POINT. For every gas there is a *critical temperature*, above which it cannot be liquefied (*see LIQUEFACTION*) no matter how great a pressure is applied. The pressure necessary to liquefy the gas at its critical temperature is the *critical pressure*. A gas at its critical temperature and subjected to its critical pressure is at its *critical point*. Under these conditions, the liquid and vapor states merge together and cannot be separated into liquid and vapor phases, as can be done when liquefaction occurs below the critical temperature.

CRITICAL TEMPERATURE. *See LIQUEFACTION OF GASES.*

CRITICAL TEMPERATURE IN METALLURGY is defined as that temperature at which a slowing up occurs in either the cooling or heating curve of a metal or alloy, the arrest being caused by the absorption or evolution of heat produced by (1) a change of phase (*see PHASE RULE*), (2) an allotropic change (*see ALLOTROPY*), (3) the formation or dissociation of a compound, or (4) by an other internal energy change.

The cooling of a 0.50% carbon steel may be taken as an illustration. The steel remains liquid on cooling until a temperature of 1480° C. is reached. At this point the liquid solution begins to freeze, the solidification continuing to 1425° C. with the evolution of latent heat. This produces a retardation in the cooling curve due to change of phase. On further cooling the solid solution of iron carbide in gamma iron remains as such until 760° C. is reached. At this temperature the gamma iron begins to change to alpha iron and the carbide begins to precipitate. These changes continue to 690° C. and produce another retardation in the curve (critical range due to allotropic change and compound precipitation). Upon further cooling no additional critical ranges occur.

C. L. C.

CRITICISM, in philosophy, a term usually identified with the philosophy of IMMANUEL KANT (1724-1804). The critical philosophy is a mediator between RATIONALISM on the one hand and EMPIRICISM on the other, and is in no sense dogmatic. Beginning with the problem of knowledge, it tries to find the truth contained in both rationalism and empiricism. Holding that knowledge is a joint product of the sensibility and the understanding, it endeavors to learn just what is contributed by sense and what by reason. The answer to this question, as given by criticism, is that sensibility gives the material, and understanding the form of knowledge. Criticism is therefore transcendental, for it goes beyond both reason and sense. Kant developed this philosophy in his three *Critiques*, the first dealing with pure reason, or knowledge; the second with practical reason, or morals; and the third with judgment, or the aesthetics and teleology.

CRITICISM. *See DRAMATIC CRITICISM; TEXTUAL CRITICISM.*

CRITTENDEN COMPROMISE, a proposal to avert the CIVIL WAR, introduced in the United States Senate on Dec. 18, 1860, by John J. Crittenden, mem-

ber from Kentucky. He hoped to separate the slavery question from politics by means of a Constitutional Amendment which would reestablish the MISSOURI COMPROMISE line, forbidding slavery north of the line and allowing new states south of the line to settle the status of slavery in their respective constitutions; protect slavery in the District of Columbia against adverse legislation as long as slavery existed in Maryland and Virginia; and provide for compensation by the Federal Government to the owners of fugitive slaves who eluded recovery. Accompanying the proposed Amendment were resolutions for thorough execution of the laws for suppression of the slave trade and for equalizing the fee basis of the FUGITIVE SLAVE LAW. Since the compromise was defeated in committee, it became evident that the issues in dispute could not be settled peaceably.

CROATIA, until 1918 a province of the Austro-Hungarian monarchy. In that year it was incorporated in the newly created kingdom of YUGOSLAVIA. It occupies the northwestern part of the country, and stretches from the shore of the Adriatic to the Drave River. It is bounded on the south by Dalmatia, on the west and northwest by Istria, Carniola and Styria, and on the southeast by SLAVONIA, its sister province. The capital of Croatia-Slavonia is Zagreb, on the banks of the Save River.

History. The Croats were south Slavs, and migrated to their present home from eastern Galicia. They took possession of Dalmatia and Pannonia, former provinces of the Roman Empire, in the 7th century. By the year 900 they had accepted Latin Christianity. Their first king, Tomislav, they elected in 924. In 1102 the kingdoms of Croatia and HUNGARY were united under one king, although the ruler was the only real connection between the two. From 1192 to 1437 Croatia was under the sway of Anjou, Naples and Luxembourg, but kept its individuality. During this period Croatia carried on almost incessant war with the republic of VENICE. From 1437 to 1699 the Croats defended themselves against the Turks, and were never conquered by them as were the Bosnians. They protected the entire Balkan peninsula from the invaders. In 1848 the Croats under Yelatchich suppressed the Maygar revolution which threatened to disrupt the Dual Monarchy, and in 1879 helped to establish the authority of Austria-Hungary in Bosnia and Herzegovina. Dalmatia received representation in the Hungarian Diet following the assumption of sovereignty in the Balkans in 1908. With the disruption of the Austro-Hungarian Empire, the Croats proclaimed their union with Yugoslavia. The many differences arising since then have resulted in a new movement for the establishment of an autonomous Croat state.

CROCE, BENEDETTO (1866-), Italian philosopher and aesthetician, was born in the province of Aquila, Feb. 25, 1866. He was educated in Naples where he later settled to spend his life as a private scholar. In 1903 he founded the journal *La Critica*,

and in 1920-21 was Minister of Education under Giolitti. He has also served as senator. Croce combines German idealism with a historical and cultural interest. His chief work, *The Philosophy of Spirit*, consists of *Aesthetic*, 1902, *Logic*, 1905, *The Philosophy of the Practical: Economics and Ethics*, 1909, and *History, Its Theory and Practice*, 1920.

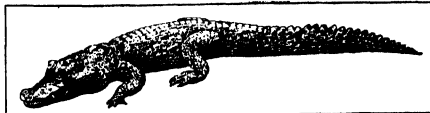


A FRENCH, LATE GOTHIC, CROCKET From the Cathedral of Notre Dame, Paris

CROCKET, in medieval architecture, a projecting ornament of foliage, usually simple below, and growing richer as it rose and curved out. In early Gothic work the crocket was tightly rolled and bud-like, the projecting portion usually approximating a sphere. In the later Gothic, the forms were more loose, unrolled, complicated and full of reverse curves. In the 15th and 16th centuries tremendously intricate involved forms like seaweed were common. Crockets are usually used in rows on the edges of spires and gables, or under cornices.

CROCKETT, DAVID (1786-1836), American frontiersman, was born in Greene Co., Tenn., Aug. 17, 1786. As a boy he learned to be an expert hunter, trapper and rifleman, and in 1813-14 he served under Jackson against the Creek Indians. In 1821, he was elected to the Tennessee Legislature, served two terms, and in 1826 was sent to Congress where he was known for his eccentric manners, odd clothes, rustic wit, and native shrewdness. He originated the maxim, "Be sure you are right, then go ahead." After serving three terms as Congressman, and failing to be elected for a fourth, he joined the Texas army, then engaged in war with Mexico, and in 1836 was one of the six survivors of the 140 men who defended the ALAMO. When these men surrendered, Crockett was killed by an order of Santa Anna, at San Antonio, Mar. 6, 1836.

CROCODILE, a term referring in its broadest sense to any member of the order *Crocodylia* (*Loricata*) but more specifically applied to *Crocodylus* and two allied African genera of but a single species each.



COURTESY AMER. MUS. OF NATL. HISTORY

BROAD-NOSED CROCODILE

The *Crocodylia* alive to-day, though the largest of living reptiles (*C. porosus*, the salt-water crocodile of the East attains a length of slightly over 30 ft.), are a mere remnant of a remarkable past, extending back at least to Jurassic times. This is evidenced by the wide distribution and great numbers of fossil remains. Extinct forms are estimated to have reached a length of

50 ft. Allowing duly for differences of opinion, the 11 to 13 recent species of *Crocodylus* and its allied genera, form roughly half of the extant crocodilian fauna of about 24 species. There are two alligators (United States and China), one gavia (India), the false gavia (East Indies) and seven caimans (South America).

The true crocodiles are widely distributed in the tropical regions of the world. In general, they are distinguished by the fact that the fourth tooth of the lower jaw fits into a groove in the upper. This tooth fits into a pit in the caimans and alligators. Gavials are recognized by their long snouts. Crocodiles are carnivorous and oviparous. They are often found together in great numbers and prefer large bodies of shallow water, sluggish rivers or open swamps. Their prey is swallowed whole or in large pieces. Once seized by several individuals, a large animal is quickly dismembered and torn to pieces. This is accomplished by a series of rapid revolutions of each crocodile on the long axis of its body. The sexes find one another by the help of scent glands and voice. C. H. P.

CROCUS, in Greek mythology, the lover of the beautiful nymph Smilax. The gods turned her into a flower and Crocus into a saffron plant.

CROCUS, a numerous genus composed chiefly of very early blooming perennials belonging to the Iridaceae family, several of which are widely grown garden ornamentals. There are about 75 species, natives mostly of the Mediterranean region. They are stemless plants with grass-like root leaves rising from fibrous-coated, solid bulbs or corms. The attractive flowers, which are produced among the leaves at the surface of the soil or appear before them, have a very long, slender tube that raises the expanded upper portion above the ground. In color crocuses range from white to yellow, orange and lilac. There are also several autumn blooming kinds, as the saffron crocus (*C. sativus*). Although upward of 30 species have been more or less grown by floral specialists, the most popular crocuses have been derived from a few species, among which are the common crocus (*C. vernus*), the so-called Scotch crocus (*C. biflorus*), the cloth-of-gold crocus (*C. susianus*) and the Dutch crocus (*C. maciatus*). See also SAFFRON.



CROCUS
A rock garden species



DWARF AUTUMN FLOWERING CROCUS

called Scotch crocus (*C. biflorus*), the cloth-of-gold crocus (*C. susianus*) and the Dutch crocus (*C. maciatus*). See also SAFFRON.

CROESUS, King of Lydia, 560-546 B.C., famous for his enormous wealth. He completed the conquest

of the Ionian seaboard and extended his empire to the Halys River. Apprehensive of the rising power of Persia under Cyrus, he formed alliances with Babylonia, Egypt and Sparta. To bolster his confidence for the expected struggle he consulted the Delphic oracle, but received an ambiguous answer. Cyrus by superior generalship forced Croesus back to his capital, Sardis. Capturing Sardis, 546 B.C., Cyrus added Lydia to his kingdom. After a picturesque attempt to commit suicide on a great pyre, Croesus was rescued by Cyrus, who gave him a position of honor in his court.

CROKER, JOHN WILSON (1780-1857), British statesman and author, was born at Galway, Ireland, Dec. 20, 1780. After being graduated from Trinity College, Dublin, in 1800, he devoted himself to the law and literary pursuits. He was elected to Parliament for Downpatrick, 1807, to be prominent until 1832 when, an opponent of the Reform Bill, he retired. He was one of the earliest contributors to the *Quarterly Review* and assisted in founding the Athenaeum Club. He wrote on a wide range of subjects. His most important work was the editing of Boswell's *Life of Johnson* published in 1831. He died at St. Albans Bank, Hampton, England, Aug. 10, 1857.

CROKER, RICHARD (1841-1922), political leader, was born in County Cork, Ireland, Nov. 23, 1841, and brought to New York in 1843. During his youth he was a gang leader on the East Side. In 1865 he allied himself with Tammany Hall. Through serving successively as alderman, coroner and fire commissioner, his power increased until in 1886 he became the acknowledged leader of Tammany Hall. For 17 years, except for a brief residence abroad, he dictated the program of that political body. He retired as leader of Tammany in 1902, and went to live in England and Ireland, where he owned several racing stables. His race horse, Orby, won the English Derby in 1907. Croker died near Dublin on Apr. 29, 1922.

CROME, JOHN (1768-1821), known as Old Crome, English landscape painter, the founder of the Norwich School, was born at Norwich, Dec. 22, 1768. His father, a poor weaver, apprenticed him to a house painter. Through the assistance of a rich friend, Crome established himself as a drawing teacher and in 1805 became president of the Norwich Society of Artists. He learned his art by studying the Dutch landscapists and sketching from nature. Trees were his specialty and he has been called "the master of the Oak." His admirable landscapes, which have fine atmospheric tone, fluent brushwork and fidelity to nature, received little recognition during his lifetime. The Metropolitan Museum, New York, has his *Old Houses at Thorpe, Hautbois Common, Landscape and A Roadway*. Crome died at Norwich, Apr. 22, 1821.

CROMER, EVELYN BARING, 1st Earl (1841-1917), British statesman and administrator, was born at Norfolk, Feb. 26, 1841. Son of the head of

the banking firm of Baring, he entered the army, subsequently becoming private secretary to the viceroy of India. In 1877 he went to Egypt as commissioner of public debt, and later was made consul general and agent. Egypt was then in poor financial condition, but so successful was Cromer in effecting sweeping reforms, that he earned for himself the designation of "Maker of Modern Egypt." Because of ill health, he resigned from Egyptian service in 1907. He is the author of *Paraphrases from the Greek Anthology, Modern Egypt, and Political and Literary Essays*. He died at London, Jan. 29, 1917.

CROMPTON, SAMUEL (1753-1827), English inventor, was born in Firwood, Lancashire, Dec. 3, 1753, and when a boy entered the weaving trade. The inadequate performance of the machines then used induced him to experiment with improvements and in 1779 he produced the spinning mule by which he could spin yarn suitable for making muslin. Because he could not afford to patent his invention he made private arrangements for its use by several manufacturers, most of whom refused later to pay him, and he realized less than £70 for his machine. Eventually parliament awarded him £5,000. He died in Bolton, June 26, 1827.

CROMWELL, OLIVER (1599-1658), Lord Protector of England and a member of one of Elizabeth's Parliaments, was born at Huntingdon, England, Apr. 25, 1599. He was the fifth child and only surviving son of Robert Cromwell. His great-grandfather, Sir Richard, was the son of Morgan Williams, but assumed the name of his maternal uncle, THOMAS CROMWELL, the vice-regent of Henry VIII. Oliver received his education at the free school of Huntingdon and at Sidney Sussex College, Cambridge, an institution known as a nursery of Puritanism, to which he was admitted in Apr. 1616. He did not complete his university course; his father's death in June 1617 probably gives both the occasion and date of his withdrawal. A little later he read law in Lincoln's Inn, London, a natural step for a country gentleman who might expect to be a justice of the peace and member of Parliament. He married in 1620 Elizabeth Bouchier, daughter of a London merchant, who brought with her considerable dowry. In 1628 Cromwell was elected to represent his native town in the third Parliament of CHARLES I. This Parliament is noted for its opposition to the King's constitutional and ecclesiastical policies; and Cromwell was among the King's opponents, especially on matters relating to the Church. Member of a family that owed its position and fortune to the Reformation, educated by a Puritan schoolmaster and at a Puritan college, Cromwell was a Puritan by inheritance and conviction, and inevitably a foe to the Laudian regime.

After the dissolution of Parliament in 1629 Cromwell returned to Huntingdon; but in 1631 he sold his farm and moved a few miles away to St. Ives. Five years later, having inherited property from an

uncle, he moved to Ely, where he lived until 1647. His life during the period of Charles I's personal rule was quiet, though not entirely uneventful. He was fined for failure to assume the burdensome honor of knighthood; but there is no record of his refusal to pay ship-money, though JOHN HAMPTON, famous for his opposition to that financial expedient, was his first cousin. If Cromwell's zeal for Puritanism won for him the approbation of many, his vigorous defense of the rights of peasants and small proprietors in these years was a greater factor in widening his influence. When the King's non-parliamentary government collapsed, Cromwell was elected member of Parliament for the borough of Cambridge, first to the Short Parliament that met for 23 days in the spring of 1640, and then to the LONG PARLIAMENT, which met in November of that year and was in session when civil war broke out. The commons in this Parliament were virtually unanimous in their opposition to the arbitrary power of the Crown and in their intention to check the growth of absolutism. The division of opinion came later, over ecclesiastical policies; and Cromwell was among the protagonists of the Root and Branch Bill which aimed at abandoning the principles of the Elizabethan religious settlement, abolishing the hierarchy, and erecting a new established Church under Parliamentary control.

The civil war made Cromwell a national figure. Before hostilities commenced he subscribed £500 to the fund for raising an army, sent arms at his own cost to his constituents, and secured for the Parliamentary cause the plate of the University of Cambridge and the county magazine. The value of his services to the Parliamentary cause during the war can hardly be overestimated. Without any military training or experience, Cromwell proved himself one of the ablest cavalry generals in modern times. Of at least equal importance were his gifts as an organizer; the new model army was, in the main, his creation; and to him, more than to any one else, was due the victory of the Parliamentarians.

In the summer of 1649, some six months after Charles I's execution, Cromwell was sent to Ireland, where a union of Protestant royalists and Roman Catholics had proclaimed CHARLES II and endangered the infant English commonwealth. In nine months he subjugated the greater part of the island; then came the Cromwellian settlement, which was approved of and carried out by Cromwell, even if not initiated by him. Neither the conquest nor the settlement added to Cromwell's greatness; they were marked by deliberate and abominable cruelty and they gave to Ireland a heritage of grievances that lasted into the 20th century. It was because of threatened invasion from Scotland that Cromwell was recalled. On Sept. 3, 1650 Cromwell won a decisive victory at Dunbar; by Christmas the greater part of Scotland had submitted; on the anniversary of the Battle of Dunbar Cromwell ended his military career by winning at Worcester a victory over the Scots army that had crossed the border with King Charles.

The mistakes of the RUMP PARLIAMENT, their treatment of the army, and their endeavor to perpetuate their own indefinite continuance in office, aroused deep resentment. Of this disaffection Cromwell made himself the mouthpiece and on Apr. 20, 1653 he went with a body of soldiers to the Parliament house and drove the members out. For a few months England was governed by the so-called Barebones Parliament, the members of which on Dec. 12 surrendered their authority to Cromwell. Four days later Cromwell became ruler of the three kingdoms with the title of Lord Protector. After the enactment of a new constitution in 1657 Cromwell was a second time installed in office.

Cromwell's government of England was stern and honest. He was unable to govern with Parliament; his record during the protectorate shows him opposed to representative government; but, while his rule was more tyrannical than that of the Stuarts, it was also far more efficient. His foreign policy was pursued with vigor and crowned with success; he raised England's prestige to the highest point it had reached since the days of Elizabeth, though he was unable to realize his dream of a league of Protestant states. His ideals were theocratic rather than liberal, and his public acts as well as his private life were dominated by his religious beliefs. That his system did not long survive him was due primarily to the fact that it was essentially a military despotism, contrary to the political genius of the English people. He died at Whitehall Sept. 3, 1658.

A. H. S.

BIBLIOGRAPHY—F. A. Inderwick, *The Interregnum*, 1891; C. H. Firth, *Oliver Cromwell*, 1900; T. Carlyle, *Cromwell's Letters and Speeches*, ed. by C. S. Lomas, 1904; C. H. Firth, *The Last Years of the Protectorate*, 1909; S. R. Gardiner, *History of the Commonwealth and Protectorate*, 1913; *History of the Great Civil War*, 1914.

CROMWELL, THOMAS (c. 1485-1540), Earl of Essex, English statesman, was born in Putney, about 1485. He was the son of a blacksmith, and had an adventurous career in England and on the Continent. In 1523, he became a member of Parliament, and succeeded in ingratiating himself with HENRY VIII who showered him with honors including those of chancellor of the exchequer, lord privy seal, lord high chamberlain, and in 1540 was created Earl of Essex. When in charge of enforcing the Act of Supremacy, 1535, he began the suppression of the monasteries and confiscation of their property. In 1530 he arranged the marriage of Henry VIII and Anne of Cleves and ten years later fell from royal favor partly because of Henry's displeasure with Anne. He was beheaded on Tower Hill, July 28, 1540.

CRONJE, PIET ARNOLDUS (c. 1840-1911), Boer general and patriot, was born about 1840 in the Transvaal. In the first Boer War, in 1881, he headed the forces that besieged the British at Potchefstroom, and was second in command at Doornkop and at Majuba Hill. In 1896 he captured the Jameson raiders at Krügersdorp. In the war of 1899, in supreme command over 6,000 men, he fought brilliantly

against the English at Modder River and defeated them at Magersfontein. In 1900 he opposed the approach of the enemy under Lord Roberts on Pretoria, but having been surrounded at Paardeberg lack of ammunition finally forced his surrender. He was then imprisoned on the island of St. Helena until the termination of the war. Cronje died February 4, 1911, at Klerksdorp, Transvaal.

CRONSTADT CANAL, in Russia, constituting a link between Cronstadt on the Gulf of Finland and Leningrad. The canal proper is only about 6 mi. long, but including the sailing course in the Bay of Cronstadt, has a total length of 16 mi. In 1890 this waterway was opened, having a navigable depth of 20½ ft., the original depth being increased 11½ ft., and a width ranging from 220 to 350 ft. The construction of this canal has given Leningrad an important commercial advantage. Previously ships had unloaded at Cronstadt and had their cargoes transported by small steamers to Leningrad. Since its opening vessels have been able to pass directly through the canal to the port of Leningrad.

CRONUS, in Greek mythology, the god of agriculture, called by the Romans SATURN. He was the son of GAEA, the earth, and URANUS, one of the Titans. He married RHEA. Among their children were ZEUS, HERA and POSEIDON. Cronus seized the throne of his father, but in turn was warned that his son would overthrow him. As his children were born the god swallowed them. When Zeus was born, however, Rhea gave Cronus a stone which he swallowed instead. Zeus later seized the throne and made his father disgorge the other children.

CROOKES, SIR WILLIAM (1832-1919), English physicist and chemist, was born at London, June 17, 1832. In 1861 he isolated the metal thallium. Later he turned to problems of radiation and invented the Crookes Tube (see X-RAYS), a high vacuum-tube emitting X-rays. His further researches into radiation led him to formulate theories concerning the ultimate unity of the constitution of matter and force, which prepared the modern electronic hypothesis. He constructed the radiometer and invented the spintharoscope. The Nobel Prize in chemistry was awarded him in 1907. He died at London, Apr. 4, 1919.

CROOKES' TUBE, an X-ray tube of the focus type developed by Sir William Crookes for the study of the conduction of electricity through gases at very low pressures. See also ELECTRONICS; X-RAYS.

CROOKSTON, a city in northwestern Minnesota, the county seat of Polk Co., situated on the Red Lake River, 30 mi. southwest of Thief River Falls. Two railroads serve the city. The river supplies a part of the water power for the manufacture of flour, food products, sashes, doors and cigars. Crookston is a market center for farm crops, sugar beets and livestock. It is the seat of the Northwest School of Agriculture of the State university, and the northwest Agricultural Experiment Station. Every February the Red River Valley livestock and agricultural show

is held in Crookston. It was also the scene of the International Air meet in 1928. The city was founded in 1872 and chartered in 1883. Pop. 1920, 6,825; 1930, 6,321.

CROP PROCESSING MACHINERY, machines used in rendering crops suitable for market or for animal or human consumption. In this group there are threshers, hullers, graders, cleaners, shellers, shredders, cutters, grinders, balers, gins, juice mills, dryers and dehydrators.

The development of this class of machinery is closely associated with that of the steam engine, stationary gasoline engine and tractor, since high-speed operation is required. See also THRESHERS; HULLERS; GRADING MACHINES; SHREDDERS; COTTON GIN; BALERS; CANE MILL; DRYERS; DEHYDRATORS.

CROQUET, an outdoor lawn game played with mallets, balls and wickets. The sport is a development of pall mall, favorite pastime of Charles II and his court in the 17th century. Croquet should be played on a lawn, or a loam and clay court, usually 60 feet long by 30 feet wide. There are 10 arched wickets made of wire, measuring about 4 inches in width, and extending between 8 and 9 inches above the lawn. These wickets are placed on the court in a prescribed arrangement. (See Spalding's *Lawn Sports*, 1930.) The most difficult to pass through is the center cage, which consists of two wickets, one placed diagonally over the other. Stakes are set at each end of the court. Croquet balls are of wood, and should measure 3⅞ inches in diameter, and weight 16 ounces. Mallets may be of any size; but the conventional mallet-head is 7½ inches long, with a diameter of 2¼ inches. In playing an extra stroke is won for every wicket the ball passes through and two strokes if a ball is roqueted. To roquet is to strike an opponent's ball. Having accomplished this, the player places his ball against that of his opponent, then strikes his own ball. In this way a player may dislodge his opponent's ball from a favorable position, meanwhile winning additional strokes for himself. American variations of croquet are Tight Croquet, akin to billiards, on a grand scale, and Hun Croquet.

CROSBY, FANNY (1820-1915), American hymn writer, was born at Southeast, Putnam Co., N.Y., Mar. 24, 1820. When a child she lost her sight, and at 15 entered the Institution for the Blind, New York City, remaining as pupil and teacher 25 years. In 1858 she married Alexander Van Alstyne. She published verse, but is best known for her hymns. Among the most popular of these are *Pass Me Not, O Gentle Saviour, Safe in the Arms of Jesus and Rescue the Perishing*. She died Feb. 12, 1915.

CROSS, SAINT JOHN OF THE (Juan de Yezpe Alvarez) (1542-91), Spanish mystic, was born at Hontiveros, Old Castile, in 1542. In 1563 he joined the Carmelite Order, and, soon after, became a devoted follower of Saint Teresa, applying her ideas to the reform of his order. He was immediately persecuted by his former brethren, and imprisoned for nine months, only emerging through the influence

of Saint Teresa. Banished to the Sierra Morena where his health was undermined, he was permitted to go to Ubeda (Jaen), where he died in 1591. He was canonized in 1726. His poetical and prose works, which are all devotional, are of an eloquent beauty, and show religious ecstasy in its highest form.

CROSS, WILBUR LUCIUS (1862-), American educator and author, was born in Mansfield, Conn., Apr. 10, 1862. He graduated in 1885 at Yale and took his Ph.D. there in 1889. In 1894 he began teaching English at the Sheffield Scientific School, Yale, became professor in 1902, and in 1921 Sterling professor of English. In 1916 Cross was made dean of the Graduate School at Yale. He edited the *Yale Shakespeare* and wrote *The Life and Times of Laurence Sterne*, 1909; *A History of Henry Fielding*, 1918, and *Modern English Novel*, 1929. In 1930 Cross was elected governor of Connecticut, and was reelected in 1932.

CROSS BILL, in equity practice, a cross suit brought by a defendant against a plaintiff or other parties in a pending suit with respect to the matter set up in the plaintiff's bill. The purpose is to obtain full relief with respect to the matters involved in the suit, since a court of equity having obtained jurisdiction of a subject proceeds so far as possible to dispose of it completely.

CROSSBILL, a genus (*Loxia*) of small birds of the finch family so named because the curved mandibles of the bill are crossed at the tip. They are somewhat parrot-like birds, about the size of an English sparrow, natives chiefly of northern coniferous forests, in the trees of which they climb about using the feet and bill with almost equal facility. Their food consists mostly of the seeds of the pine, spruce and fir, which they readily extract from the cones by means of their crossed bills. The American crossbill (*L. curvirostra minor*), with dull red and brownish plumage, breeds from Alaska to Newfoundland southward to the Rockies and the Alleghenies. The similar white-winged crossbill (*L. leucoptera*), with pinkish coloration and white wing-bars, is native to northern North America and also to western Europe. Both species are erratic in their migrations and occasionally invade the northern United States in large numbers.

CROSS-COUNTRY RUNNING, a competitive foot-race, generally held over rough terrain. This is one of the earliest known forms of sport, and was an event of long tradition with the Greeks. Modern cross-country racing falls in the category of long-distance running, and is thus allied with steeple-chasing and road-racing. It differs from steeple-chasing in that cross-country obstacles are natural handicaps afforded by the nature of the ground; and from road-racing, in that the runners in cross-country events avoid roads so far as possible, most of the course being over fields and lightly wooded areas. The sport enjoys a limited popularity in the United States, where it is recognized by a few universities, but has no official status with the AMATEUR ATHLETIC UNION. In England, however, cross-country running enjoys wide

favor. The chief cross-country races are the International, at Leamington; National; Inter-county, and the Oxford and Cambridge. In the 1930 International, held over a distance of 10 miles, the entries represented England, Scotland, Wales, Ireland, France, Belgium, Switzerland and Spain.

CROSSCUT, in metal mining, a horizontal underground passageway driven across a vein, thereby exposing its width. Crosscut, in coal mining, is a short connecting passage through the PILLAR between two headings or Rooms. They are cut at 60 to 100 ft. intervals and serve to return air from one HEADING to the other. A crosscut is closed when another is made ahead of it. It is sometimes termed a "break-through." See also MINE DEVELOPMENT; DRIFT; MINING; COAL; MINING, METAL.

CROSS ENTRY, in coal mining, an entry driven at an angle, usually of 90°, to the main ENTRY. This, like the main entry, generally consists of two or more parallel and adjacent passageways. See also MINING, COAL.

CROSS-EXAMINATION, a questioning of a witness at a trial or hearing by the party opposed to the one producing him in order to test the truth of his statements or develop them further. In England, a witness may be a cross-examined on any matter relevant to the case whether covered by the direct examination or not. This practice obtains in some of the United States, but the general rule in the United States confines cross-examination to matters about which the witness was examined in the first instance. Cross-examination was employed in the canon law and in the civil law where the judge questioned witnesses upon interrogatories prepared by the parties in advance. But its real development took place in English law in connection with trial by jury. It is an exceedingly effective instrument for discovering the truth.

CROSS-POLLINATION, in botany, the process of fertilization which involves pollination between different species, resulting in hybridization. See POLLINATION.

CROSS RELATION, known also as false relation, a musical progression in which two different degrees of the same note are successively sounded by different voices. Although, like all formally prohibited progressions in HARMONY, it may be found in the scores of the masters, undoubtedly it is undesirable in most cases; for this reason it has been laid under a general proscription, which is violated in the following illustrations:



CROSSWORD PUZZLE, a diagram consisting of small squares, each to be filled in, unless shaded, with a letter forming a part of two words, one running crosswise and the other downwards. Numbers are placed in certain squares, to indicate the beginning of

a word. They correspond to those of the key accompanying the diagram, which gives a definition of the word to be filled in. The simplest crossword puzzle is a rectangular diagram, divided by an even pattern of shaded squares. This can be varied by a more complex arrangement of the squares. Another type indicates the end of a word by a heavy line. In the diagramless puzzle no hint is given as to the length and position of words. Recent inventions include giving clues in verse and prose, merely alluding to the word, or having each word identical in some quantity, such as the prefix or suffix.

Crossword puzzles originated in England during the 19th century and were mainly printed in children's magazines. Wide interest in them began to be shown about 1923, and they have held a continued popularity in England and the United States since then. They have been made more difficult to solve, and now often require a special technical knowledge for solution.

CROTON, a very numerous genus of plants of the spurge family, comprising about 700 species, natives chiefly of warm and tropical regions, several of which possess medicinal properties. The seeds of *C. Tiglium*, a tree of tropical Asia, yield croton oil, a powerful cathartic. Cascarilla bark, used as a tonic, is obtained from *C. Cascarilla*, a native of the Bahamas. Several species, as *C. lacciferus*, of India and Ceylon, and *C. Draco*, of Mexico, produce resins employed in making varnish. For the croton of florists, see **CODIÆUM**.

CROTONA (COTRONE), an ancient town of Brutium, or Bruttium, southern Italy, situated on the Ionian Sea. A Greek colony under the leadership of Myscellus settled here in 710 B.C. Its medical school, dating from the time of Herodotus, was renowned in the Greek world. Pythagoras founded a school here. Crotona was the birthplace of Milo and many celebrated athletes, and held a high place in the Olympic games because of the splendid climate. The Locraians and Phlegians conquered Crotona in 480 B.C. The city gave its allegiance to Hannibal after the Battle of Cannae. Rome took it in 277.

CROTONALDEHYDE, a colorless liquid with an intensely irritating odor, boiling at 104°C., and having the formula $\text{CH}_3 \cdot \text{CH} : \text{CH} \cdot \text{CHO}$. It is manufactured by converting **ACETALDEHYDE** into acetaldol with an alkali. The product is acidified and crotonaldehyde is distilled off.

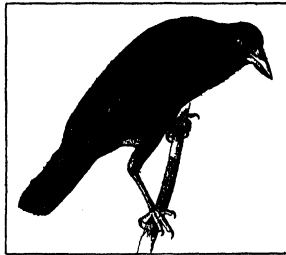
It is used as an intermediate in the preparation of **RUBBER ACCELERATORS**.

CROTON BUG (*Estobia germanica*), an orthopterous insect of the family *Blattidae*, known also as a cockroach. The Croton bug is a small, tan-colored insect, about ½ in. in length. Like the other species of roach, it has an excessively flattened body, long antennae and a disagreeable odor. The eggs, contained in a curious pod, are carried about by the female until nearly ready to hatch. The Croton bug gets its name from the fact that it became noticeable in New York when Croton water was introduced, though it is of foreign origin. See **COCKROACH**.

CROTON OIL. See **CATHARTICS**.

CROUP. See **CHILDREN, DISEASES OF: Respiratory Diseases**.

CROW, a familiar bird, the type of the crow family (*Corvidæ*). There are two American species, the common crow (*Corvus caurinus*), generally dis-



AMERICAN CROW

tributed and with five geographic races; and the smaller fish crow (*C. ossifragus*), limited to the Atlantic and Gulf coasts, and subsisting mainly on fish and crustaceans.

The crow, unlike the raven, which disappears before man's advance, has spread and multiplied with man's civilization, until now it flourishes from Mexico to northern Canada. Pre-historically confined, probably, to the open central parts of the United States, it has accompanied the clearing and cultivation of the continent. Human activities have greatly increased its food-resources and reduced its natural enemies,



FROM MAXIMILIAN VON WIED-NEUWIED'S ATLAS

CROW INDIANS

From a drawing by Karl Bodmer

while its native wisdom and cunning enable it to cope with the new circumstances and enmities it has had to meet. The crow is omnivorous, and of some service as a scavenger and devours vast numbers of injurious insects and their larvæ. On the other hand, when very numerous, they ravage maize fields in the spring by pulling up the sprouting corn, to get at the seed kernels; and they, especially fish-crows, are the

worst of all robbers of birds' nests. The general conclusion is that crows should not be exterminated, but should be controlled where necessary. Crows make rude nests in tall trees, and lay greenish, thickly spotted eggs. They are hardy enough to remain all winter in their accustomed haunts, except in northern Canada, and they assemble each night from miles around in roosts numbering thousands. Young crows are easily trained and, like parrots, are often taught to talk. E. I.

CROW, or Absaroke, as they call themselves, a Siouan-speaking Plains Indian tribe now living near Lodge Grass, Mont. According to their traditions, which have been upheld by historical and cultural evi-



FROM GEORGE CATLIN, NORTH AMERICAN INDIANS

CROW INDIANS TRAVELING

dence, the Crow several hundred years ago were a member of the Hidatsa group of tribes living along the Missouri River. Following an internecine dispute one band migrated to the Rocky Mountains where they remained until segregated on a reservation. They were divided into two local bands, the Mountain Crow, occupying southern Montana and part of Wyoming, and the River Crow who occupied the lower Yellowstone. Prior to their separation from the Hidatsa, they were constantly at war with other Plains tribes, particularly the Blackfoot and Dakota. In historic times they were a typical nomadic Plains people, lived in tipis, cultivated nothing but tobacco,

which involved a complicated ceremonial procedure, were skilled horsemen, hunted the buffalo, wore the typical Plains costume skilfully embroidered with porcupine quills, possessed a series of age-graded societies for men and women and performed the sun dance.

CROWBERRY (*Empetrum nigrum*), a low, much branched, evergreen shrub of the crowberry family, common in rocky places and moors widely throughout the Northern Hemisphere



P. A. RYDBERG "FLORA OF PRAIRIES AND PLAINS"

CROWBERRY

and extending also to the Andes. It bears small, crowded leaves, minute purplish flowers and black or purplish-red, edible berries, which are extensively eaten by birds.

CROWFOOT, the common name given to the various species of *Ranunculus*, especially those with

conspicuous flowers and pedately divided leaves. The species with showy, brilliant flowers are also known as **BUTTERCUP**. The name is likewise applied to numerous other plants having similarly divided leaves, as the buck's-horn plantain (*Plantago Coronopus*) and the cut-leaved crane's-bill (*Geranium dissectum*). See also **RANUNCULUS**.

CROWLEY, a city in southwestern Louisiana, the capital of Acadia parish, situated 22 mi. west of Lafayette. It is a shipping center served by buses and three railroads. Rice is the chief crop of the parish. Crowley, the "Rice City of America," mills large quantities of this cereal. There are also machine shops and cotton gins. The city was founded about 1886 and incorporated in 1887. Pop. 1920, 6,108; 1930, 7,656.

CROWN IMPERIAL (*Fritillaria imperialis*), a bulbous plant of the lily family bearing large, smooth leaves and showy, lily-like flowers. It is a native of Persia, often cultivated for its stately and handsome appearance. The purplish, brick-red or yellowish-red flowers, about 2 in. long, hang in a small cluster beneath a terminal tuft or crown of leaves borne above the rest of the foliage.

CROWN JEWELS, decorative emblems worn by monarchs, the chief of which, in European countries, is a richly jeweled crown. The significance of this regalia varies greatly in different countries.

The English regalia includes crowns, scepters, orbs, the staff of Edward the Confessor, an ampulla, an anointing spoon, swords, bracelets, spurs and coronation rings; of these, the most important are the crowns. The King's Royal Scepter is of gold, richly jeweled and about three feet in length. It was made for Charles II, and Edward VII had the famous diamond known as the principal Star of Africa inserted. There are two orbs, one for the king and the other for the queen. These are jeweled balls of gold, each bearing a jeweled cross. Among the five swords are the Sword of State, the highly valuable Jeweled Sword of State used at coronations, the Curtana, or sword of mercy, and the swords of religious and temporal justice. The golden spurs, known as St. George's Spurs, are used at coronations. The bracelets, part of the insignia of royalty since ancient times, bear enameled designs representing the emblems of the three kingdoms. The coronation rings, a recent addition to the crown jewels, include the King's Ring, the Queen's Ring and a special ring made for Queen Victoria. The British crown jewels are exhibited to the public in the Tower of London.

While the Scottish crown and part of the Scottish regalia have been preserved in Edinburgh Castle, the



CROWN IMPERIAL

Irish crown jewels were stolen from Dublin Castle, and have never been recovered.

The Russian crown jewels which were unsurpassed in splendor, have, since the downfall of the Romanoffs, apparently been despoiled. These included the Imperial Crown and the Empress's Crown, the scepter bearing the famous Orlov diamond, the uncut diamonds known as the Moon of the Mountain and the Shah and a ruby known as the Polar Star, Paul I's jeweled sword and an imperial diadem containing 126 pearls and 584 diamonds. The imperial crown was topped with a large ruby and a cross composed of five great diamonds.

In the Louvre at Paris, the crown, sword and spurs of Charlemagne are preserved, along with a miscellany of French historic jewels. Most of the treasures of Valois, Bourbons and Bonapartes have been scattered, as the French crown jewels were sold at auction in 1887. The ancient Iron Crown of Lombardy, a gold, jewel-encrusted band said to bear a nail from the Cross, is the outstanding item among the crown jewels of Italy. The Braganza diamond, said to be the largest diamond known, is among the jewels of Portugal. Important among the once famous crown jewels of Vienna are the Imperial Crown and the Crown of Hungary.

CROWN OF THORNS (*Euphorbia splendens*), a remarkable plant of the spurge family, native to Madagascar and grown in conservatories for its striking appearance. The thick, somewhat climbing, almost leafless stems, 3 to 4 ft. long and densely beset with stout spines, bear long-stalked clusters of inconspicuous flowers subtended by broad, vivid red, petal-like bracts.

CROWNS, decorative head bands worn to indicate leadership or supreme power. Crowns can be traced from the Roman and Greek wreaths, that were awarded to winning athletes in games or given to a member of a tribe or to a citizen for meritorious services, as in battle. Closely associated with the wreath is the diadem, which was developed further with fleur de lis, crosses, shields and arches into a crown.

The head bands of crowns have been made of a variety of materials ranging from iron to gold studded with precious



FIG. 1. CROWN OF LOUIS XV OF FRANCE

stones. To the head bands shields, rosettes, crosses, arches and other ornamentations have been added. Of the famous early crowns may be mentioned the iron crown of Lombardy made in the 8th century and used by Napoleon Bonaparte at his coronation, consisting of gold plates outside of an iron band. Charlemagne's crown now at Vienna, has on it religious figures, alternating with jeweled designs. Although of a later date, mention should be made of the crown of Louis XV of France (see Fig. 1) that had a jeweled band

surmounted by eight fleur de lis bearing arches supporting a large double fleur de lis.

Other notable crowns are the German imperial crown with shields and crosses on the head band, and four arches on the top of which is a cross. The crown of the Holy Roman Empire is shown in Fig. 2. That of St. Stephen of Hungary has a band, from

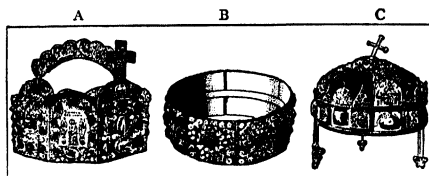


FIG. 2. ANCIENT CROWNS OF EUROPE
A, So-called Charlemagne crown of the Holy Roman Empire. B, Iron crown of Lombardy. C, St. Stephen's, the royal crown of Hungary

which rises four arches, at their intersection is a cross, the unique feature being the pendants (see Fig. 2). The Czar of Russia crown was noted for its precious stones, as are also the crowns of many princes of India.

The present royal crowns of England include the three crowns of the reigning sovereign, viz., St. Edward the Confessor's Crown or the Crown of England, the Imperial State Crown, and the Imperial Crown of India; the two crowns and a diadem which pertain to the Queen Consort; and the crown of the King's eldest son. Since 1661, the kings and queens of England have been crowned with the Crown of England. The Imperial State Crown, which only dates from 1838, when it was made for Queen Victoria, is considered the most valuable crown in the world. The Imperial Crown of India came into existence when George V was crowned Emperor of India.

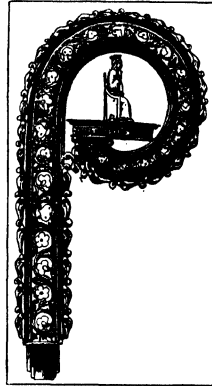
CROYDON, a suburb of London and the largest town of Surrey, England, forming a municipal, parliamentary and county borough. Omnibuses, trolleys and the Southern Railway afford transportation. The city is especially noted for its airdrome, called the London Terminal Aerodrome, located at Waddon, 2 mi. southwest. Opened in 1915 and redesigned in 1927-28, this is one of the finest airports in the world. The Manor of Croydon was presented by William the Conqueror to Archbishop Lanfranc. The latter built here a great archiepiscopal palace, portions of which still stand. Other noted buildings of Croydon are the Whitgift Hospital, established in 1599 by Archbishop Whitgift; the Whitgift Grammar School, 1562; the parish Church of St. John the Baptist, dating from the 14th-15th centuries and rebuilt in 1870, and the Bethlem Royal Hospital, erected in 1928-30. Pop. 1921, 191,375; 1931, 233,115.

CROZIER, WILLIAM (1855-), American major-general, was born in Carrollton, O., Feb. 19, 1855. After graduating from West Point in 1876, he took part in the campaigns against the Sioux

and Bannocks (1876-78), was a staff officer in the field in the Philippine insurrection of 1900, and on Nov. 22, 1901, became chief of the Ordnance department, U.S. Army (rank of brigadier-general), with which service he since identified himself. He was president of the Army War College in 1912-13, and was made chief of Ordnance again, Oct. 1917, serving in this capacity in France until Dec. 1918. He was a member of the War Council in France

from Dec. 1917 until June 1918. In July 1918, he was given command of the Northeastern Department, U.S. Army, which he held until Dec. 1918, when he retired with the rank of major-general. General Crozier invented with General Buffington the Buffington-Crozier disappearing gun carriage which was adopted for army use, and is the author of *Notes on the Construction of Ordnance*, an authoritative textbook on the subject.

CROZIER or **PASTORAL STAFF**, one of the oldest insignia of bishops, used at the latest at the beginning of the 7th century. It was at first a



COURTESY M. M. OF ART

CROZIER OF ST. PETER
German silver-gilt metal work,
17th century

stout cane for support, with a crook at the top. About 1000 it was greatly lengthened and in place of the crook an ornamented, carved top of ivory was substituted. Since the 16th century the curvature has been pointed outward, to symbolize, it is said, the bishop's jurisdiction. The simpler crozier of the abbot was held with the curvature inward to indicate that his power was limited to his abbey. Many of the pastoral staffs were ornamented with figures and elabo-



STEEL WORKERS REMOVING CRUCIBLE OF MOLTEN STEEL FROM FURNACE

rate designs of ivory or metal, and are museum pieces. The bishop holds the staff in his left hand while he imparts the blessing.

CRUCIBLE STEEL is made by melting, at about 2900° F., puddled iron of high purity together with a few ounces of charcoal and ferro-manganese in a

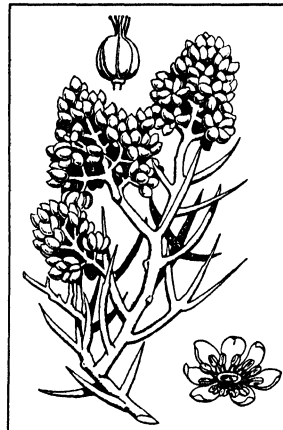
barrel-shaped vessel called a crucible holding 100 lbs. Crucibles in England are made of clay, those in the United States of clay and 50% Ceylon graphite.

Melting furnaces in English practice are heated by coke, while in the United States they are gas fired. The crucible is kept in the furnace from two to four hours. The steel obtained from the crucible is of the highest quality.

Crucible steel contains .60 to 1.5% carbon, .30% manganese, .020% maximum phosphorous, .020% sulphur, .30% silicon. Steels with .50 to .70% carbon are for battering tools and hammers; .80 to .90% carbon for chisels, sledges, and punches; 1.00 to 1.40% carbon for cutters, drills, razors and files.

For alloy steels, ferro tungsten, chromium, vanadium, titanium, zirconium or metallic nickel are added. See CHROMIUM STEEL; VANADIUM STEEL; NICKEL STEEL; TOOL ALLOYS. C. M. J.

CRUCIFIXION THORN (*Holacantha Emoryi*), an exceedingly thorny shrub of the quassia family found in southwestern deserts. It occurs in arid districts from the northern parts of the Mohave Desert



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

CRUCIFIXION THORN
Pistils, fruiting branchlet and staminate flower

to southern Arizona and Sonora. The plant grows 5 to 8 ft. high with rigid branches, scalelike leaves, numerous small flowers borne in dense clusters on the branches and dry, drupelike fruits.

CRUIKSHANK, GEORGE (1792-1878), English artist and caricaturist, was born in London, Sept. 27, 1792. He possibly inherited his talent from his father and grandfather, both painters, and early developed great skill as an etcher. For a generation he was one of the leading caricaturists in England. His cartoons were published as separate caricatures or were contributed to such magazines as the *Satirist*, *Town Talk* and *The Scourge*. His famous book illustrations are

more genially humorous. The works illustrated by him include *Grimm's Fairy Tales*, *Peter Schlemihl*, Dickens's *Oliver Twist* and *Sketches by Boz*, and Ainsworth's *Jack Sheppard*. Cruikshank died in London, Feb. 1, 1878.

CRUISERS. naval vessels of three essential types, the battle cruiser, the armored cruiser and the light cruiser.

Battle cruisers came into use because of the development by a leading nation, of armored cruisers, of 9 in. guns, and later 12 in. guns. Battle cruisers are the latest development in cruisers, faster than all war vessels except DESTROYERS, and second only to BATTLESHIPS in armament. The Battle of the Falkland Islands, where the *Invincible* and *Inflexible* destroyed the German ships in the South Seas, showed their value. Roughly, a speed of 33 knots has been attained. Eventually, in accordance with the treaties of Washington and London, battle cruisers, which have already been abandoned as a type by the United States, will disappear from the lists of the leading maritime nations. They have proved unsuitable for fighting in the van of a fleet in action.

Armored cruisers were developed in the 19th century for tactical considerations. The earliest type was designed in 1878, with armored sides and decks, having a 14 knot speed, 1,200 mile radius and carrying 10 in. guns. It has gradually been replaced. Protected cruisers, also an extinct type, had armored decks but no side armor, while unprotected cruisers had neither.

Light cruisers up to 10,000 tons, and carrying 6 to 8 in. guns, are allowed under the LONDON TREATY.

R. E. C.

CRUSADES. The series of great military pilgrimages to Syria undertaken by the Christians of western Europe between 1095 and 1291 are designated as the crusades, but it should be remembered that, historically speaking, these are only a phase of the long struggle between East and West, between Europe and Asia. In the Middle Ages that struggle became also a conflict between Christianity and Islam, and of this the crusades are the second chapter, the reaction of Christian Europe to the Saracen conquests of the 7th and 8th centuries. Prior to the crusades Christians had been combating Islam in Spain, in the Mediterranean, and on the eastern frontiers of the Byzantine Empire. Before the 10th century Christianity was on the defensive, but thereafter, despite various reverses, the Europeans were attempting to avail themselves of the political disunion in the Moslem world to recover territory previously lost to Islam. The Spanish kings had begun the reconquest of their peninsula. Italian cities and Normans were occupying the Mediterranean islands and attacking North Africa. The Macedonian emperors at Constantinople had had some success in regaining parts of Syria. Feudal adventurers from northern and western Europe were beginning to find in these wars against the Moslems opportunities for profitable, personal conquests, particularly in Spain and southern

Italy. At the same time Pisa, Genoa, and Venice, in the interests of trade, were reasserting European naval power in the Mediterranean. It is also significant that the Popes, the Venetians, and the south Italian Normans were becoming interested in the east, not because of the Moslems, but because of difficulties with the Byzantines. Furthermore a popular interest in pilgrimage to the Holy Sepulchre had been growing during the 11th century due to the religious revival following the Cluniac Reform, encouraged by the improved opportunity which followed the conversion of Hungary to Christianity in 1000.

At this juncture a series of events in the Moslem world served to intensify the Christian-Moslem struggle. In the West the Almoravides brought a new threat to Christian Spain. In the East the Seljuk Turks appeared, and by gaining political and military control of the Bagdad Caliphate put new life into that hitherto moribund Moslem state. The Turkish Sultans then turned to the conquest of Asia Minor, a region which the Byzantines had always held successfully against the Caliphs. In 1071 at Manzikert in Armenia the Turks annihilated the Byzantine army. This event, and the Byzantine civil war which followed it, enabled the Turks to occupy Asia Minor and conquer Syria. The Byzantine military system went to pieces, so that Alexius Comnenus, when he seized the imperial throne in 1081, had to recruit his armies with foreign mercenaries. This caused him to turn to western Europe. One of his predecessors had already in 1073 made approaches to Pope Gregory VII for military assistance, and the pontiff had contemplated the organization of an expedition which would not only repel the Turks but would also effect a union of the Eastern and Western churches.

First Crusade. At the date when Alexius was approaching the Papacy for assistance, the Popes, under the impulse of the Hildebrandine ideals, were attempting to assume the moral leadership of Latin Christendom. The needs of the Christian East offered an opportunity for Pope Urban II to further papal ambitions by stirring up a popular movement of militant pilgrimage for the recovery of the Holy Sepulchre under papal direction. He took the occasion of a church council at Clermont in 1095 to preach a holy war and to launch an active propaganda, which one may suspect was more successful even than had been expected. In 1096 large, unorganized bands of pilgrims made their way through Hungary to Constantinople. By attempting to live off the country enroute, they antagonized the inhabitants, who inflicted heavy losses on them. When they crossed over into Asia the Turks cut them to pieces. Real crusading armies reached Constantinople late in 1096, Rhinelanders under Godfrey of Bouillon, Provençals under Raymond of Toulouse, south Italian Normans under Bohemund. But the Emperor's desire for mercenaries to reconquer Asia Minor only partly coincided with the crusaders plan to conquer Jerusalem,

a plan which included the personal ambitions of some of the leaders to win principalities for themselves. This divergence caused friction between crusaders and Byzantines which lasted throughout the crusading period.

Early in 1097 the Christians invaded Asia Minor, successfully besieged Nicaea, and defeated the Turks at Dorylaeum. In crossing Asia Minor they lost heavily, more from want than from the enemy. In October at Antioch the army reached the sea where the Italian ships brought supplies. After eight months the place was gained by treachery, and successfully defended against a relieving Turkish army. Dissensions arose because the leaders, aiming to gain territories for themselves, often quarreled and occasionally turned aside for expeditions of personal conquest, while most of the army desired to push on to Jerusalem to fulfill their vows at the Holy Sepulchre. A year of recuperation, bickering, and local conquest held the crusaders at Antioch, while the Egyptians seized the opportunity to recover Jerusalem from the Turks. In June 1099, however, Godfrey and Raymond appeared before the city, took it by storm, June 15, and massacred the Moslem defenders. Two months later the defeat of the Egyptians before Ascalon ended the campaign. The First Crusade had been a success. It was the only crusade which did succeed, and its victory was due to the fact that it came at a moment when the Seljuk power was beginning to decline, when the Moslems were divided, the Turks and Egyptians being more hostile to each other than to the Christians. Consequently the latter, at the moment when their fanatical zeal was strongest, met only local resistance.

Settlement in the East. Most of the crusaders, being pilgrims, returned home after the recovery of the Holy Sepulchre. Only a small group of adventurers remained to conquer the Syrian coastland and to establish the Latin Kingdom of Jerusalem (*see* JERUSALEM, LATIN KINGDOM OF) with its vassal states at Antioch, Edessa, and Tripoli. They were ambitious to conquer Egypt also but were never strong enough to attempt it without help from Europe. The establishment of a European colony on the western coast of Asia provided the Italians with opportunity for trade with the east, and for western Christendom an occasion for greatly increased pilgrimage. The travel back and forth was persistent, traders, pilgrims and adventurers going to seek their fortune in the colony or to help defend the Latin Kingdom against the Moslems. To provide for both pilgrims and defense the Military Orders were organized, bodies of knights under monkish vows who devoted themselves to the holy war. These were the Knights of St. John (the Hospitalers), the Templars, and later the Teutonic Knights. The great expeditions which are referred to in history by number are really intensifications of a continuous stream of pilgrim travellers brought about by crises in the affairs of the Latin Kingdom.

Those crises resulted from the reuniting of the

Moslem powers whose disunion had made possible the success of the First Crusade. In 1144 Zenghi, atabeg of Mosul, ambitious to control all Syria, both Moslem and Christian, recovered Edessa for Islam. The Papacy called for a new crusade, and St. Bernard undertook to preach the need for rescuing the Latin East. Louis VII of France took the cross to ease a troubled conscience, while the Emperor Conrad III succumbed reluctantly to the eloquent saint. The Second Crusade, led by the two chief sovereigns of the west, was a much more pretentious effort than the First. But the two armies found it hard to co-operate, and consequently endured great losses in crossing Asia Minor. When they reached Syria they attacked Damascus in July 1148 but their assaults were repulsed, whereupon the westerners broke off and returned home blaming the local Christians for their failure.

By submitting to the overlordship of the Byzantine Emperor the crusader states gained some support during the next 30 years, partly because Zenghi's son, Nur-ed-din, was occupied with the conquest of Damascus and Egypt. His victories created a united Moslem power encircling the Christians. His successor SALADIN prepared to renew the Moslem Holy war and to recover Jerusalem. In a rapid campaign in 1187 he overran the Latin Kingdom, capturing its king and capital. Europe responded with an expedition under Frederick Barbarossa, Richard the Lion-hearted and Philip Augustus, the Third Crusade, "the most formidable military undertaking of the medieval period." But the aged emperor was drowned in Asia Minor, and the two kings were too hostile to each other to be able to act together. Philip returned home after the fall of Acre, leaving Richard to war unsuccessfully against Saladin until 1192, when he made a truce which permitted limited pilgrimage to the Holy Sepulchre.

Later Attempts. The failure to recover the Holy City kept the agitation for crusading alive for 300 years, but the organization of expeditions to the east lasted only another century. Papal influence, which had been effective at the start and which aimed at religious ends, was giving way to the more worldly motives of feudal adventurers and Italian merchants. The Fourth Crusade in 1204 is an outstanding illustration of this. Launched by Pope INNOCENT III it came to be dominated by the Venetians, who had satisfactory trade relations with Egypt but who were on bad terms with Christian Constantinople. Under their influence the crusading army was persuaded to intervene in Byzantine politics. Eventually it took Constantinople by storm and never went to fight the Turks. A Latin Empire with crusader rulers was set up and maintained for half a century. The BYZANTINE EMPIRE never recovered either power or prestige after this blow.

Later expeditions were directed to the Holy Land or against Egypt with some success. By negotiation, the Emperor FREDERICK II secured possession of Jerusalem in 1229 and the Christians held the city until

1244 when the Egyptians recovered it. In consequence of this loss Louis IX of France led a new crusade and invaded Egypt in 1249, but his army was routed and he himself was captured. The Mameluke revolution in Egypt in 1250 provided Islam with new fanatical leaders, imbued again with Saladin's determination to recover all of Syria. In 1268 they took Antioch, an event which inspired Louis IX to another crusade. But this last effort turned aside to conquer Tunis where its leader died and nothing was accomplished. The Mameluke conquest of Syria continued. Tripoli fell in 1289, and the crusading kingdom came to an end in 1291 with the loss of Acre. Christian rule continued in Cyprus until 1571, while the Hospitallers maintained themselves at Rhodes until 1522 and at Malta until 1798.

Results. As religious and colonizing enterprises the crusades were failures, but their incidental consequences were considerable, although we must guard against ascribing too much to their influence. They provided the occasion and the stimulus for overseas trade between east and west and very important results followed from that development. The return of Europe to a money economy was hastened by this trade expansion. Town life flourished as commerce revived. Maritime improvements came with more extensive navigation. The use of the magnet resulted from contact with the east. Business needs helped to start banking. Commercial enterprise led to geographical exploration. The movement of population tended to broaden the European point of view. The east provided an opportunity for those who were discontented at home. The losses of crusading fell particularly upon the feudal nobility and so contributed to that disintegration of feudalism which the return to money economy was hastening. The kings, merchants and serfs all benefitted by this disintegration. In the religious field there were no benefits. The very idea of religious war is an unChristian concept borrowed from Islam. The Papacy, having assumed the lead, was discredited by the eventual failure of the crusading movement and by its practice of preaching crusades against heretics and papal enemies in Europe. The extensive sale and use of indulgences resulted from crusade recruiting. Only in the fields of heraldry and military architecture did the crusades exercise a cultural influence upon the west. The other and more important influences of Saracenic civilization were determined by contacts in Sicily and Spain rather than in Syria. R. A. N.

BIBLIOGRAPHY.—T. A. Archer and C. L. Kingsford, "The Crusades" in *Stories of the Nations*, 1895; W. B. Stevenson, *The Crusaders in the East*, 1907; E. Barker, *Crusades*, 1923; R. A. Newhall, *The Crusades*, 1927; L. Brehier, *L'Eglise et l'Orient au moyen age les croisades*, 5th ed., 1928.

CRUSHED ROCK. See AGGREGATES.

CRUSHER GAUGE, a hollow steel cylinder containing a piston, an obturator and a cylinder of soft copper or similar material, used to measure pressures in firearms. The piston is connected to the powder chamber of the firearm and receives the full pressure of the gas at the time of firing. The pressure is de-

termined by comparing the compression of the copper cylinder with tables of compressions made from data taken on static machines. See also ARTILLERY; BALLISTICS.

CRUSHERS, called also "breakers" in Ore Treatment, machines used for crushing ore and rock. Ores are crushed as they enter the Mill, preparatory to finer Grinding. In disc crushers of the Symons type, two steel discs rotate in the same direction, one having a gyratory movement. Gyratory crushers, such as the Gates, consist of a vertical spindle, the top carrying a crushing head, which revolves eccentrically in a conical maw. In jaw crushers, as the Blake or Dodge type, the rock is crushed between two movable steel plates set at an angle to each other.

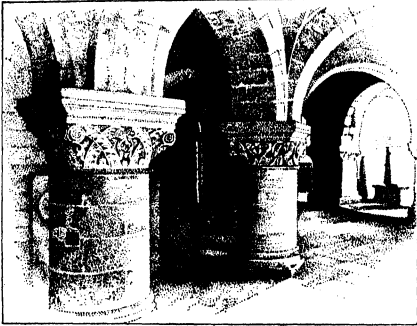
CRUSTACEA, the scientific name for a great class of invertebrate animals of the phylum Arthropoda. Members of this class have hardened cuticles or "shells" which usually show evidence of the characteristic segmentation of their bodies. They vary greatly in form; some, as the Ostracoda, have bivalve shells or carapaces, and the barnacles have very complex shells. The tiny copepods of the sea are the most important crustaceans in the economy of nature. More familiar are the lobsters, crayfish and crabs. Most species are marine, but some, as the fairy shrimps, are abundant in even small fresh-water pools, while the woodlice are terrestrial, and live under stones and leaves, and on decaying wood. See also CRAB; CRAYFISH; LOBSTER; PRAWN; SHRIMP; WATER-FLEA.

CRUX (gen. *Crucis*), the Southern Cross, the most striking constellation in the southern sky, is just visible from southern Florida and Texas during the early evenings in May. It consists chiefly of two blue stars of the first magnitude, ALPHA CRUCIS and Beta Crucis, one red star of the second magnitude, Gamma Crucis, and one blue star of the fourth magnitude, Delta Crucis. The four stars may be considered to form a cross or a kite. When due south the longest arm of the cross stands straight up in the sky, pointing down toward the south pole.

The Southern Cross appears projected against one of the brightest parts of the Milky Way. Immediately to the left of it is a dark cloud, the so-called Coal-Sack, while further to the left are Alpha and Beta Centauri, both of the first magnitude. Taken altogether, the region of the Southern Cross may well be considered the most magnificent in the sky. See STAR: map.

CRYOLITE, a mineral ranging in complexion from colorless to white and reddish, once used as the principal Ore of aluminum. Ordinarily it is translucent to transparent, with a glassy or slightly greasy appearance. Cryolite is a fluoride of sodium and aluminum, crystallizing in the MONOCLINIC SYSTEM. The principal use for it to-day is in the chemical industries, for enamelware manufacture, and for the molten bath used in extracting aluminum from BAUXITE. The chief source is a PEGMATITE vein in granite, situated near Ivigtut in western Greenland. See also ORE DEPOSITS.

CRYPT, an underground story of a church. The word, which comes from the Greek and Latin verbs, to hide, means literally a hidden room, and in the early Christian Era was applied to a secret chapel in the catacombs. Later the word came to be applied to underground tombs, and when, in early Romanesque



CRYPT IN THE CATHEDRAL OF SAINT DENIS, NEAR PARIS, WHERE A NUMBER OF THE KINGS OF FRANCE ARE BURIED

times, it became the custom to permit burials under a church, the open space which gave access to these tombs was called a crypt. Often the crypt was built under the choir only, and in the Italian Romanesque examples was high enough to afford the crypt light, air and easy access, through an arcade open to the nave and called a *pontile*.

CRYPTESTHESIA, the name given by Charles Richet to the general or alleged power to see or hear or get impressions at a distance or through obstacles in a manner beyond the ordinary use of the senses. Richet and others regard this as an established form of supernatural sense. It is an hypothesis to account for the reading of sealed messages, for second sight, premonition, and similar transcendent capacities which find no place in accredited psychology. They constitute a part of **METAPSYCHICS**.

CRYPTOGRAPHY, the art of writing in cipher, or of making written records intended to be intelligible only to one who has the key to their translation. Cryptography, or secret writing, has been employed since the days of Sparta; government officials and departments have used it for centuries to preserve secret records or to deliver confidential information, particularly in the diplomatic service or during time of war; certain business records are kept, or messages delivered, in the same way; and the underworld freely resorts to it.

Codes and ciphers are the methods employed in cryptography, although the actual cryptographic message itself is sometimes called the code or cipher. In the simplest form of cryptography, one letter is consistently substituted for another, e.g., *n* is always used for *s*, *r* for *m*, etc. Sometimes symbols are adopted instead of letters—a dot for *e*, a dash for *c*, etc.; or a group of letters may replace a single letter, or vice

versa. Sometimes the real letters are used, but the order is changed until chaos results unless one has the key; and mechanical devices are also employed, as punched cards.

Very elaborate systems have been developed that have long defied analysis. Expert cryptographers have proved, however, that because of the peculiarities of a language, e.g., the frequency with which certain letters or combinations of letters are used, it is next to impossible to evolve a code that cannot ultimately be solved by someone who has not the key. K. D. S.

BIBLIOGRAPHY.—André Langie, *Cryptography*, trans. by J. C. H. Macbeth, 1922.

CRYPTOMERIA (*Cryptomeria japonica*), a handsome evergreen tree of the **PINE** family, native to eastern Asia and often cultivated for ornament. It is of pyramidal growth, sometimes 125 ft. high, with a straight slender trunk, whorled spreading branches and small bluish-green leaves. The roundish, reddish-brown cones are about an inch across. The tree, which runs into many varieties, furnishes good timber.

CRYSTAL, usually a solid, but not necessarily so, which tends to be bounded by natural plane faces, more or less symmetrically arranged. It shows other definite geometrical properties, also consequent upon the arrangement of constituent molecules. If free to follow their normal atomic attraction, the atoms will arrange themselves in certain geometrical patterns, called "space lattices," as a crystalline substance forms from solution, fusion or gaseous sublimate. Consequently certain directions of growth will be favored, and crystal faces develop. Common salt usually forms in cubes, diamond and magnetite in octahedra, and quartz in six-sided prisms capped with a six-sided pyramid. Crystal faces are not to be confused with faces impressed by external, restricting forces. Most solid elements and compounds tend to crystallize, but frequently are prevented by external interference. Many minerals in rocks fail to show crystal faces.

The atomic pattern produces other effects which serve to identify crystalline materials which show no crystal faces. Principal among these is the effect on polarized, transmitted light. This varies according to the direction of transmission through the crystal, except in the isometric system. Some minerals also show **PLEOCHROISM**, absorbing different colors of light in different directions. Similarly, heat conductivity, hardness and other properties may change with the direction. **CLEAVAGE** is a result of crystalline structure. These phenomena lead to the definition of a crystal as a substance showing like elasticities (for light, heat, etc.) in like directions. A non-crystalline substance such as glass is called amorphous. See also **CRYSTALLOGRAPHY**; **MINERAL**; **AMORPHOUS**. S. F. K.

CRYSTAL CITY, a city in Zavalla Co. in southwestern Texas, situated on the Nueces River, 115 mi. southwest of San Antonio. Bus and truck lines and the Missouri Pacific Railroad serve the city. It is a shipping center for a wide area; the chief crops of the vicinity are spinach and onions. Natural gas

is produced in the district. The river and two small lakes afford fine fishing and hunting grounds. Crystal City was founded in 1907 and incorporated in 1909. The inhabitants are predominantly Mexican. Pop. 1930, 6,609.

CRYSTAL DETECTOR, in radio, a piece of metal touching a crystal such as galena or silicon, or two dissimilar crystals in contact with each other, in such a way that the combination offers more resistance to the flow of electricity in one direction than in the other. *See also* RADIO COMMUNICATION.

CRYSTAL GAZING, the art of inducing subconscious images to appear and take pictorial form by gazing fixedly into a reflecting surface, the term being derived from the use of a glass ball to this end. The habit may be cultivated. An old English name for it is scrying. Crystal gazing is a sensory form of AUTOMATISM, revealing much the same as does AUTOMATIC WRITING. It is allied to seeing visions or hearing voices which are projected from the subjective realm. Crystal vision has been used in attempts to find lost objects or to read the future. The process has a natural explanation as a helpful method to revive subconscious impressions.

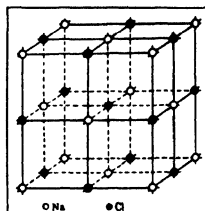
CRYSTALLIZATION, FRACTIONAL, a term used to describe the process when one of two or more substances dissolved in a solution is precipitated or crystallized, and the remaining substances are retained in solution. Ordinarily, fractional crystallization is accomplished by taking advantage of differences in solubilities of the materials in solution. The less soluble material is precipitated, either by evaporation or cooling, and the more soluble materials stay in solution. In some cases, one of the materials will form a highly supersaturated solution, or will crystallize more slowly than the other, so the second material can be recovered by quickly cooling a solution containing both materials. The precipitated substance is then removed before the slower material crystallizes.

W. L. McC.

CRYSTALLOGRAPHY, the science which treats of inanimate matter in its highest state of organization, as crystalline substances. When solids and even certain liquids crystallize, their constituent atoms are pictured as attaching themselves to each other in regular, three dimensional patterns, called space lattices. As a result of this ordered arrangement their chemical and physical properties are vectorial, that is, vary with the direction in which they are measured. They are invariable, however, for the same directions in similar crystals of a given substance, a fact of great importance in determinative mineralogy. As a result of the pattern, crystalline substances tend to form CRYSTALS, that is, solids bounded by natural plane faces in symmetrical arrangement. The study of these geometrical forms is called geometrical crystallography, while the sciences of physical and chemical crystallography deal with the correlations between crystalline structure and physical and chemical properties. Investigations along these lines have added greatly in recent years to the knowledge of the fine or molecular structure of

matter. Geometrical crystallography is indispensable to the geologist and mineralogist, since they must frequently study crystal forms in order to differentiate minerals and identify rocks. To the layman it is interesting because these forms are easily recognized, and are often striking and of great beauty.

Crystals may form when a molten substance, as copper or iron, cools and solidifies, or when a solid like

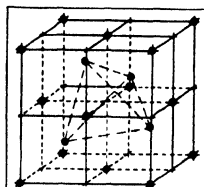


COURTESY MCGRAW HILL BOOK CO

UNIT CELL, OR FUNDAMENTAL PATTERN OF THE SPACE LATTICE IN HALITE CRYSTALS

The white circles show the positions of the sodium atoms, the black dots of the chlorine atoms

The atomic space lattices can combine, it has been demonstrated, into 230 groups. These are divisible into 32 classes on the basis of the elements of SYMMETRY they possess. The elements of symmetry are planes, axes and centers of symmetry. These symmetry classes can be further grouped into six crystal systems, in which the crystal forms are described by relating the faces to imaginary axes, called crystallographic axes. These crystal axes intersect at the center of the crystal, and are usually taken parallel to its prominent edges. They are not necessarily coincident with the symmetry axes.

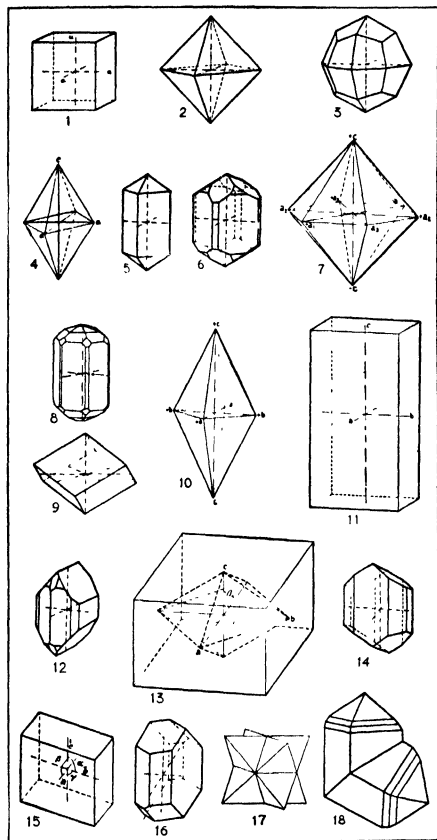


FROM KRAUS AND HUNT MINERALOGY. MCGRAW HILL BOOK CO.

UNIT CELL, OR FUNDAMENTAL PATTERN OF THE SPACE LATTICE IN DIAMOND CRYSTALS

Black dots show the positions of the carbon atoms

The crystallographic axes are named *a*, *b*, *c*. In the cubic or isometric system they are mutually perpendicular, and of equal length as indicated by the nomenclature, *a*:*a*:*a*. The cube and octahedron are typical forms, as exemplified in galena and diamond. The hexagonal system has three horizontal axes of equal length, intersecting at angles of 60° like a six-rayed star, and a longer or shorter vertical axis. They are called *a*:*a*:*a*:*c*. Six-sided prisms and pyramids are common, as shown by quartz. Some crystals belonging to the rhombohedral division of this system show only half the usual number of faces, the rhombohedron often being prominent, as in calcite. The three axes of the tetragonal system are mutually perpendicular, but only the two horizontal ones are of the



MODIFIED FROM A. N. WINCHELL'S ELEMENTS OF OPTICAL MINERALOGY.
JOHN WILEY & SONS

THE CRISTAL SYSTEMS

ISOMETRIC SYSTEM: 1, Cube, 2, octahedron, 3, trapezohedron, each with crystallographic axes indicated.

TETRAGONAL SYSTEM: 4, Tetragonal pyramid, 5, tetragonal prism and pyramid, 6, two sets of tetragonal prisms combined with two sets of pyramids.

HEXAGONAL SYSTEM: 7, Hexagonal pyramid, with crystallographic axes, a , a , a , c ; 8, hexagonal prisms, pyramids, and base

Rhombohedral Division: 9, A rhombohedron of calcite, with crystallographic axes.

ORTHORHOMBIC SYSTEM: 10, Orthorhombic pyramid, with crystallographic axes, a , b , c ; 11, microbrachy, and basal pinacoids; 12, domes, prisms, pinacoids, and pyramids, combined.

MONOCLINIC SYSTEM: 13, Crystallographic axes, a , b , c , and pyramids, shown as though within pinacoids. Note angle β between vertical and inclined axes, 14, pyramids, prisms, and pinacoids in a crystal of augite.

TRICLINIC SYSTEM: 15, Pinacoids, with crystallographic axes, a , b , c . Note that angles α , β , and γ are not right angles; 16, pinacoid, prisms, pyramids and base, in a crystal of albite.

TWINS: 17, A "penetration" twin consisting of two interpenetrating tetrahedrons, 18, a knee-shaped or "genculated" twin.

same length. Consequently the naming is $a:a:c$. Four- and eight-sided prisms and pyramids characterize the system. Zircon, rutile and chalcopyrite are tetragonal. The symbols $a:b:c$ indicate that the axes of the ortho-

rhombic system are of unequal length, though they are still mutually perpendicular. The prisms are not equidimensional in cross-section, and the faces which correspond to the pyramids of the previous classes are not all of the same size; they are called domes. Native sulphur, topaz and arsenopyrite are orthorhombic. In the monoclinic system the axes are $a:b:c$, but the a , or front-to-back axis, is inclined to the other two. Consequently some of the domes, and the basal faces, or basal pinacoids, slope down from back to front. Orthoclase, hornblende and augite belong in this system. In the triclinic system all three axes intersect obliquely and are designated $a:b:c$. The crystals of this system have an askew appearance, plagioclase feldspars being typical.

The crystal systems have been described in order of decreasing symmetry, the isometric one possessing nine planes, thirteen axes and a center of symmetry, whereas only the center occurs in the triclinic system. The full symmetry, or holohedral form may not show, as crystals are found with reduced symmetry, called hemihedral and tetartohedral crystals. Hemimorphic ones have different faces at opposite ends of the same axes.

Interference from neighboring solids, and irregular rates of growth in different directions, frequently distort crystals so the faces are of unequal development. Their true relationships are determined by measuring the angles between them. Angles between similar faces or crystals of the same substance are invariable, as discovered by Steno in the 17th century. Consequently the relative distances from the center at which a given face intersects the axes, called its axial ratios, are always the same on the same substance. The symmetry, the axial ratios, and the angles between the crystallographic axes are characteristic of a crystal.

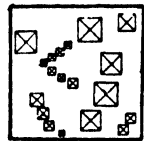
Irregular aggregates and parallel growths of crystals are often found, and frequently twinned forms are encountered, in which a crystal is in contact with its twin, either along a face or by mutual interpenetration.

The luster, hardness and CLEAVAGE of crystals, used in the study of minerals, are discussed under MINERALOGY. Another highly important physical property of crystalline substances is their effect on light and X-rays. Liquids, amorphous substances and isometric crystals refract light as it passes through them, and are known as isotropic substances. Crystals of the other systems, called anisotropic, break a light ray into two rays, and refract them differently, this being known as double refraction, or birefringence. The effect may differ in magnitude for different wave-lengths (colors), producing dispersion or scattering of the colors. The velocities of the two rays known as the ordinary and extraordinary rays also differ. If the former is slower the crystal is called optically negative, but if the extraordinary ray is the slower, it is optically positive. In addition, each ray is plane polarized, that is, the light waves vibrate in but one plane, and the planes differ for the two rays. Certain directions in anisotropic crystals are nevertheless isotropic, these direc-

tions being known as the optic axes. Hexagonal and tetragonal crystals are uniaxial because they possess but one optic axis, but orthorhombic, monoclinic and triclinic ones are biaxial. The angles between the optic axes and their positions are of importance in studying crystals. These and other optical properties are determined by examining thin sections of minerals under the petrographic, or polarizing microscope, and are of great diagnostic value in mineralogy and Petrology.

The effect on X-Rays of the atomic arrangement in crystals is similar to that of diffraction gratings on ordinary light; the successive atomic layers partially reflect the rays that penetrate to them, with consequent interference of the reflected rays. Studies of this phenomenon have yielded valuable information on the wave-length of X-rays, on the dimensions of atomic lattices, and on the actual arrangement of atoms therein.

Some chemical properties of crystals, such as their rate of solution, differ for different faces and directions. So-called etch figures eaten into crystal faces by certain chemicals indicate, by their arrangement and symmetry, the internal symmetry of the atomic lattice.



KRAUS AND HUNT MINERALOGY MCGRAW-HILL BOOK CO

TYPICAL ETCH FIGURES ON CRYSTAL OF HALITE

Four-sided pits, pyramidal in shape

Minerals with similar chemical composition which crystallize in similar forms are called isomorphous, such as orthorhombic aragonite, strontianite and witherite. A single compound which shows two or more crystal modifications is polymorphous. Iron sulphide, for example, crystallizes as cubic pyrite or orthorhombic marcasite. A pseudomorph is a substance which has assumed the crystal form of another by solidifying, for example, in a cavity left by solution of the other.

Crystals are formed artificially of many substances with great ease, but their importance is due to their occurrence in minerals found in nature, especially those which form the rocks of the globe, as discussed under MINERALOGY and PETROLOGY. See also GEM STONES; OPTICS; GEOLOGY.

S. F. K.

BIBLIOGRAPHY.—James D. Dana, *A System of Mineralogy*, 1914; Fritz Rinne, *Crystals and the Fine Structure of Matter*, 1924; G. M. Butler, *Geometrical Crystallography*, 1918; Edw. H. Kraus and Walter F. Hunt, *Mineralogy*, 1928.

CRYSTALLOIDS, a name in chemistry given to two entirely different kinds of substances. The first kind includes those compounds which, when in solution, will pass through a porous membrane, such as a piece of parchment or a bladder, as contrasted to **COLLOIDS**, which will not pass through, or *dialyse*, as this process is called. All electrolytes belong to the crystalloids, while silicic acid and the heavier organic molecules, such as glue and the proteins, are colloids. In the other meaning, the word crystalloid is used to denote those organic substances surrounding the seed and embryo of plants, which seem to serve as a reserve supply of food. They are pseudo-crystalline in ap-

pearance, but are not true crystals, in that their angles are not constant, and they can become distended in size by absorbing liquid into their interior.

CRYSTAL PALACE, a building constructed of glass and iron in the London suburb of Sydenham, England, first opened in 1854. It is a reproduction of the Crystal Palace built in 1851 by Sir Joseph Paxton for the Great London Exhibition and was constructed almost entirely of materials used in that edifice. Set within handsome 200-acre grounds, with a water tower 282 ft. high, the building itself consists of a nave 1,608 ft. long with aisles and two immense transepts (the third transept burned down in 1866), of which one contains the Handel Orchestra which seats 4,000 persons. Since 1913, when it was purchased for the nation, the Crystal Palace has been used chiefly for concerts, exhibitions, football matches and the like, and since 1920 it has housed the Imperial War Museum. The Crystal Palace in New York City was a similar though smaller palace erected in 1853 on the present site of Bryant Park, and destroyed by fire in 1858.

CRYSTALS, LIQUID, a term in chemistry applied to some peculiar formations which possess the properties of both crystals and liquids, such as silver iodide at high temperatures, p-azoxybenzoic acid, and the oleates of the alkalis, especially of ammonia. They are true crystals in that they show double refraction and appear under a microscope with a very definite form and shape, and a constant angle between their surfaces. Yet they are so plastic and elastic, that the slightest change in temperature, and even their own surface tension, makes them continually flow together, change their shapes, and re-orient themselves, from which performance they are sometimes called "living crystals."

CRYSTOLON, an artificial abrasive, made in an electric furnace from silicide of carbon. See **ABRASIVES**.

CUBA, a republic of the West Indies, situated between the Gulf of Mexico, the Strait of Florida and the Atlantic Ocean on the north and the Caribbean Sea on the south. The largest of the West Indies, Cuba, the "Pearl of the Antilles," has a length of 750 mi., a breadth varying from 27 to 150 mi., and a total area of 41,634 sq. mi. There are about 2,000 mi. of coastline, and because of numerous banks and reefs, few coasts are more dangerous for shipping, although there is no lack of accessible ports and harbors. **HAVANA** (Spanish *Habana*), the capital, is about 100 mi. from Key West, Fla.

Surface Features. In its general relief the island may be described as hilly, with moderately elevated ridges, fertile slopes, and valleys in the west; more open, with broad, gently inclined plains, broken here and there by low forest-clad hills in the center; and distinctly mountainous in the east. Above and between the terraces runs the Sierra Maestra, i.e., the main eastern range which, east of Santiago, is known as the Sierra del Cobre. The whole system culminates close to the coast in the precipitous Mt. Tur-

CUBA



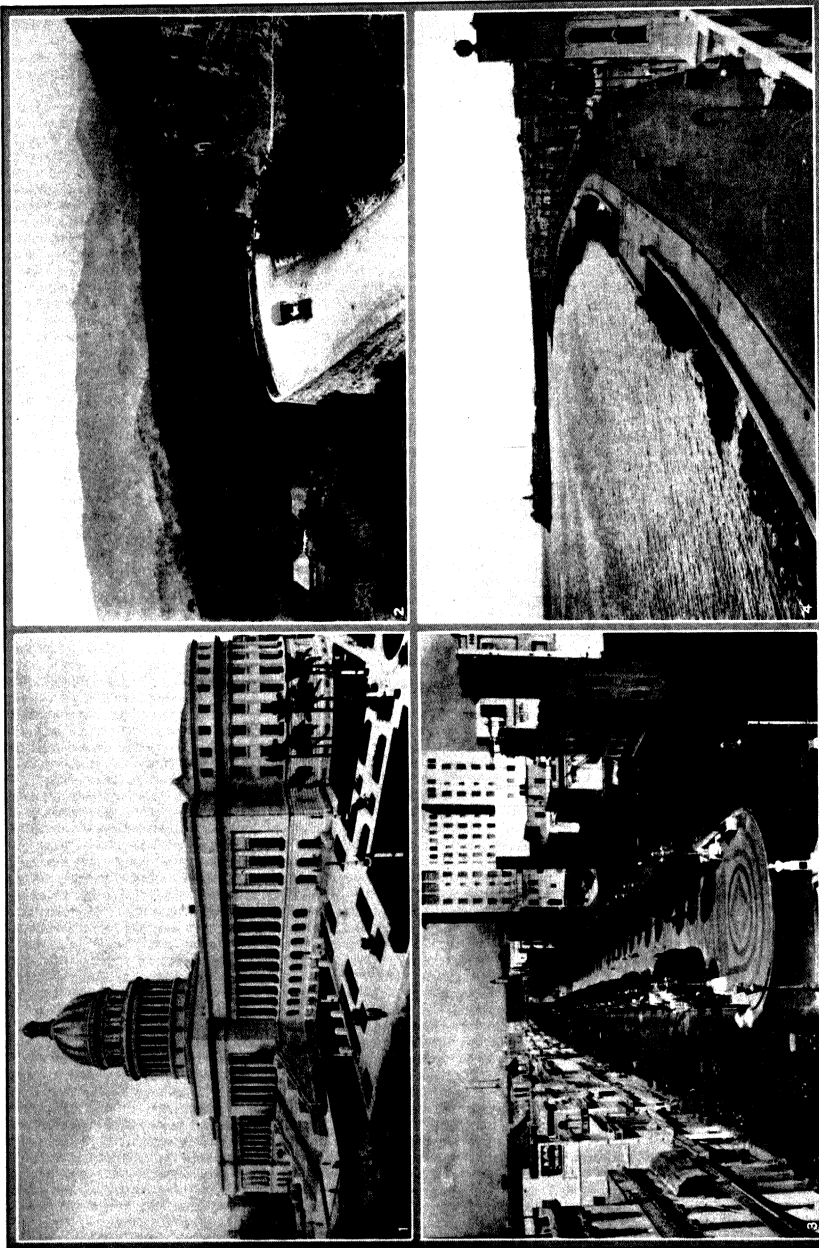
COURTESY CUBAN NATIONAL TOURIST COMM., PHOTOS FROM AMERICAN PHOTO STUDIOS, HAVANA

GOLDEN CROPS AND ENCHANTING LANDSCAPES OF CUBA

1. A view of the magnificent Viñales Valley in Pinar del Rio Province. 2. A palm-lined vista; on the right a field of tobacco covered with cheesecloth. 3. Tobacco plantation in

Pinar del Rio Province. 4. Hut in which tobacco is hung to dry. 5. The beautiful Yumuri Valley in Matanzas Province. 6. A field of sugar cane.

CUBA



COURTESY CUBAN NATIONAL TOURIST COMM., PHOTOS FROM AMERICAN PHOTO STUDIOS, HAVANA

THE OLD AND NEW IN CUBA

1. The beautiful capitol in Havana.
2. Boniato Hill, near Santiago, showing a perilous curve in the highway.
3. The attractive public walk in Havana, with Morro Castle in the distance.
4. The spacious drive along the water-front in Havana.

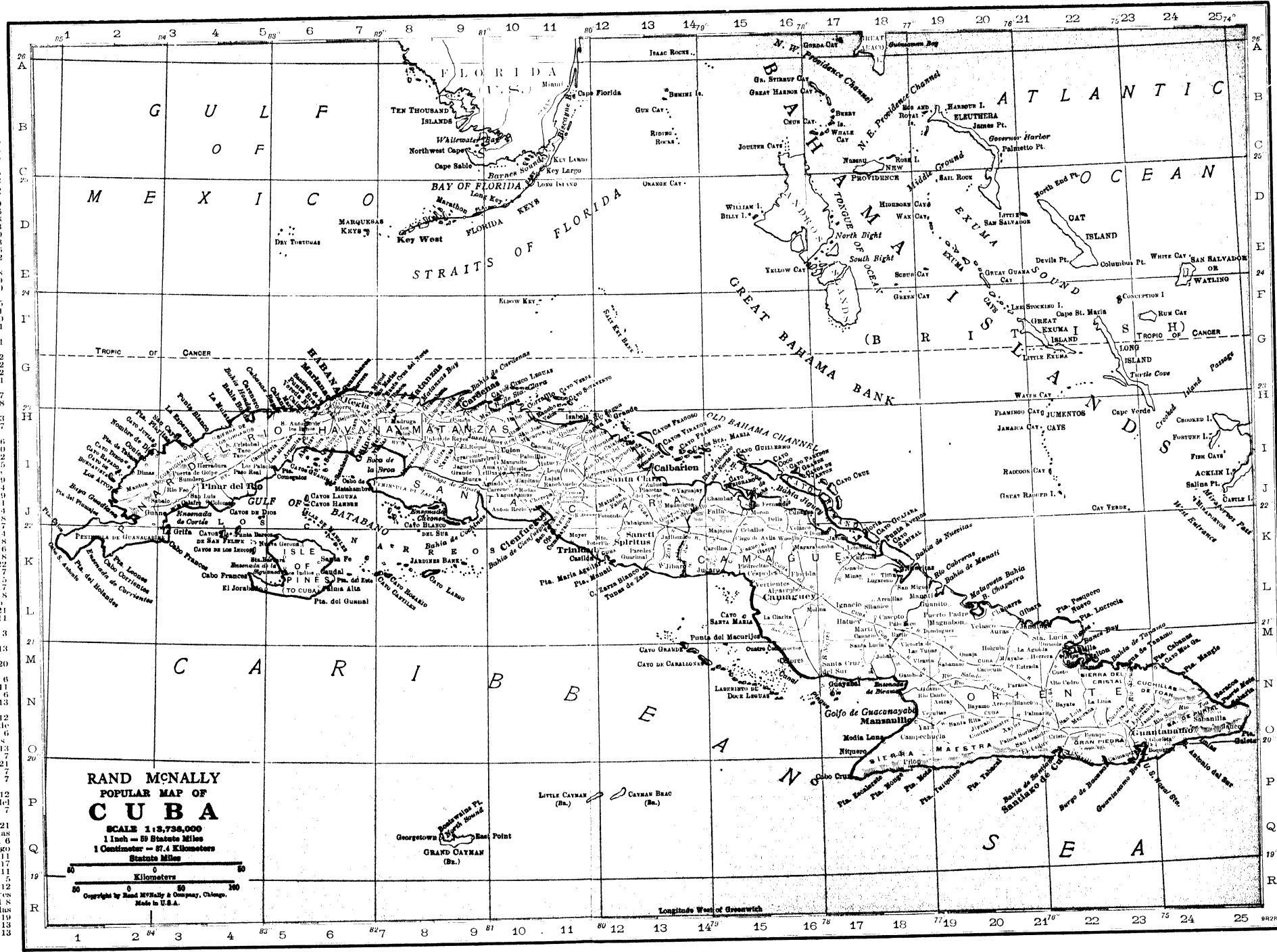
CUBA
Area 44,164 sq. mi.
Pop. 3,713,767

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)

Pop. - Thousands

- 1 Havana 1,900,000
- 2 Santiago de Cuba 1,100,000
- 3 Matanzas 1,100,000
- 4 Cienfuegos 1,100,000
- 5 Pinar del Rio 1,100,000
- 6 Camaguey 1,100,000
- 7 Sancti Spiritus 1,100,000
- 8 Remedios 1,100,000
- 9 Sagua la Grande 1,100,000
- 10 Sancti Spiritus 1,100,000
- 11 Sancti Spiritus 1,100,000
- 12 Sancti Spiritus 1,100,000
- 13 Sancti Spiritus 1,100,000
- 14 Sancti Spiritus 1,100,000
- 15 Sancti Spiritus 1,100,000
- 16 Sancti Spiritus 1,100,000
- 17 Sancti Spiritus 1,100,000
- 18 Sancti Spiritus 1,100,000
- 19 Sancti Spiritus 1,100,000
- 20 Sancti Spiritus 1,100,000
- 21 Sancti Spiritus 1,100,000
- 22 Sancti Spiritus 1,100,000
- 23 Sancti Spiritus 1,100,000
- 24 Sancti Spiritus 1,100,000
- 25 Sancti Spiritus 1,100,000
- 26 Sancti Spiritus 1,100,000
- 27 Sancti Spiritus 1,100,000
- 28 Sancti Spiritus 1,100,000
- 29 Sancti Spiritus 1,100,000
- 30 Sancti Spiritus 1,100,000
- 31 Sancti Spiritus 1,100,000
- 32 Sancti Spiritus 1,100,000
- 33 Sancti Spiritus 1,100,000
- 34 Sancti Spiritus 1,100,000
- 35 Sancti Spiritus 1,100,000
- 36 Sancti Spiritus 1,100,000
- 37 Sancti Spiritus 1,100,000
- 38 Sancti Spiritus 1,100,000
- 39 Sancti Spiritus 1,100,000
- 40 Sancti Spiritus 1,100,000
- 41 Sancti Spiritus 1,100,000
- 42 Sancti Spiritus 1,100,000
- 43 Sancti Spiritus 1,100,000
- 44 Sancti Spiritus 1,100,000
- 45 Sancti Spiritus 1,100,000
- 46 Sancti Spiritus 1,100,000
- 47 Sancti Spiritus 1,100,000
- 48 Sancti Spiritus 1,100,000
- 49 Sancti Spiritus 1,100,000
- 50 Sancti Spiritus 1,100,000
- 51 Sancti Spiritus 1,100,000
- 52 Sancti Spiritus 1,100,000
- 53 Sancti Spiritus 1,100,000
- 54 Sancti Spiritus 1,100,000
- 55 Sancti Spiritus 1,100,000
- 56 Sancti Spiritus 1,100,000
- 57 Sancti Spiritus 1,100,000
- 58 Sancti Spiritus 1,100,000
- 59 Sancti Spiritus 1,100,000
- 60 Sancti Spiritus 1,100,000
- 61 Sancti Spiritus 1,100,000
- 62 Sancti Spiritus 1,100,000
- 63 Sancti Spiritus 1,100,000
- 64 Sancti Spiritus 1,100,000
- 65 Sancti Spiritus 1,100,000
- 66 Sancti Spiritus 1,100,000
- 67 Sancti Spiritus 1,100,000
- 68 Sancti Spiritus 1,100,000
- 69 Sancti Spiritus 1,100,000
- 70 Sancti Spiritus 1,100,000
- 71 Sancti Spiritus 1,100,000
- 72 Sancti Spiritus 1,100,000
- 73 Sancti Spiritus 1,100,000
- 74 Sancti Spiritus 1,100,000
- 75 Sancti Spiritus 1,100,000
- 76 Sancti Spiritus 1,100,000
- 77 Sancti Spiritus 1,100,000
- 78 Sancti Spiritus 1,100,000
- 79 Sancti Spiritus 1,100,000
- 80 Sancti Spiritus 1,100,000
- 81 Sancti Spiritus 1,100,000
- 82 Sancti Spiritus 1,100,000
- 83 Sancti Spiritus 1,100,000
- 84 Sancti Spiritus 1,100,000
- 85 Sancti Spiritus 1,100,000
- 86 Sancti Spiritus 1,100,000
- 87 Sancti Spiritus 1,100,000
- 88 Sancti Spiritus 1,100,000
- 89 Sancti Spiritus 1,100,000
- 90 Sancti Spiritus 1,100,000
- 91 Sancti Spiritus 1,100,000
- 92 Sancti Spiritus 1,100,000
- 93 Sancti Spiritus 1,100,000
- 94 Sancti Spiritus 1,100,000
- 95 Sancti Spiritus 1,100,000
- 96 Sancti Spiritus 1,100,000
- 97 Sancti Spiritus 1,100,000
- 98 Sancti Spiritus 1,100,000
- 99 Sancti Spiritus 1,100,000
- 100 Sancti Spiritus 1,100,000



RAND McNALLY
POPULAR MAP OF
CUBA

SCALE 1:3,736,000
1 inch = 59 Statute Miles
1 Centimeter = 37.4 Kilometers

Statute Miles
Kilometers

Copyright © 1964 by Rand McNally & Company, Chicago, U.S.A.

quino, with an estimated altitude of 8,320 ft., the highest peak on the island. All of these eastern uplands are thickly wooded to their summits, plants of the cactus type on the lower and drier slopes being succeeded in the moist upper regions by wide bands of graceful tree ferns. Cuba is watered by the beautiful Yumori and numerous other rivers which generally flow through deep limestone canyons in independent channels to both coasts. But the catchment basins are narrow, and although some send down a considerable volume of opalescent water, scarcely any are navigable even for small river craft more than a few miles above their mouths. The largest is the Cauto, which winds for about 150 mi. and is accessible to boats for a distance of about 90 mi.; shallow bars, however, have been formed at its mouth. There are no extensive lacustrine basins, the largest being Lake Ariguanabo, which has an area of scarcely 6 sq. mi.

Climate. The climate of the island as a whole may be described as moderate and uniform, due to the influence of the prevailing winds, the equalizing effect of the surrounding ocean and to the fact that the long axis of the island extends east and west. The ocean breezes as a rule are quite moderate, but in the fall there is possible danger from hurricanes in the Caribbean, which are destructive every eight or ten years in Cuba. There is a dry season from Dec. to Apr., and rains from May to Nov. The highest temperature at Havana rarely reaches 98°, and the lowest 48° F.

Flora and Fauna. The flora of the island comprises over 3,000 species and the forests, covering almost half the island's surface, contain such valuable woods as mahogany, *lignum-vitæ*, grandilla, cedar, logwood and sandalwood. In addition, every tropical fruit, flower and plant thrives luxuriously in Cuba and in the mountains and high interior plains many temperate products may be raised.

Though so rich in flora, save for birds and insects, Cuba is poor in fauna. The only native mammals are the odd insectivore *Solenodon* or *almique* and the giant tree rat, *Capromys*, known locally as the *hutia*. Deer have been introduced and in many districts deer-hunting is a favorite sport. There are over 200 species of birds, many of them beautiful in color, others with wonderful song and a number hunted as true game birds. Serpents and other reptiles are common and are non-poisonous. Alligators are found in the swamps; iguanas and other lizards abound and numerous snakes, the largest of which is the Cuban boa or *maja*, are common in the forests.

Agriculture. About 5,000,000 acres are under cultivation. There are vast savannas specially suitable for cattle breeding, a considerable industry here. Cuba is the largest producer of sugar in the world, 50% of the cultivated ground being employed in its production. In 1929 the export of raw sugar was valued at \$188,636,735. The second largest industry is the raising and manufacture of tobacco. Her nearness to the United States and her satisfactory relations with that country have made it possible for Cuba to dispose

quickly of her entire annual crops in the northern market, thus outdistancing other West Indian islands. Even European beet sugar, for these reasons, has not been able to compete successfully with Cuban-grown sugar cane.

The coffee plantations were formerly the most extensive in the island, but have long been superseded by sugar culture. In the few that still remain the owners also raise other produce such as bananas, rice, cacao and all kinds of fruits. The tobacco plantations are grouped chiefly in the Vuelto Abajo, south of the Sierra de los Organos, where the best qualities are grown on the extensive level plain watered by the Rio Cuyaguaje. The plots are generally of small size, and about half the space is planted with banana trees which give good returns and at the same time afford shade to the tobacco plant. The cigar was an invention of the Cuban aborigines, and was by them called *tabacos*, a term afterwards extended to the herb itself, the true name of which is *cohiba*. The total value of the tobacco crop is between \$70,000,000 and \$80,000,000 annually. The exports of tobacco, cigars and cigarettes were valued at \$37,878,765 in 1929.

Mining. Iron is the most important mineral product; 50,000 tons of ore are shipped monthly to the United States; the reserves are estimated at over 3,000,000,000 tons. Copper is widely disseminated, and the Cobre mines, about 30 mi. north of Santiago, were at one time the greatest copper producers in the world. The Matahambre mine in the Pinar del Rio province now produces the most copper in the island. Small quantities of asphalt are exported.

Population. When Cuba was discovered, it was fairly well peopled by 30 distinct tribes whose names and territories have been carefully preserved by early writers. The Cibunys, as they were collectively called, were a branch of the widely diffused Arawak race. All of them, estimated at about 1,000,000, had disappeared before the close of the 16th century, victims of the dire oppression and cruelty of the first European planters. When all were gone they had to be replaced by other aborigines brought by the slave raiders from the surrounding mainlands and islands. These in turn were supplanted by West African Negroes who, being more robust and being reinforced by fresh arrivals, have persisted. The estimated population for 1930 was 3,713,767. In 1925 the white population was 2,315,928; colored, 829,201; Americans, Europeans, Chinese and all foreigners permanently resident, 268,087. The chief towns are Havana, the capital, est. pop. 1930, 589,079; Cienfuegos, 39,946; Camaguey, 48,773; Cardenas, 29,304. In 1928 Santiago de Cuba had a population of 48,500; Guantanamo, 13,464; Santa Clara, 26,740; Manzanillo, 24,670; Pinar del Rio, 15,951; Sancti Spiritus, 25,926; Trinidad, 13,463. Thousands of tourists from the United States visit Cuba in the winter. The island is well-equipped with railways built by private capital, and a new highway 750 mi. in length was completed in 1931. Although Havana tends to absorb all currents of life

in the land as a whole and is almost the only city which tourists visit, there are attractions in the provinces. It is in the provinces of Matanzas and Santa Clara that Cuba's most charming valleys are encountered. One of the most attractive features is the peculiar circular basin west of Matanzas, known as the Valley of the Yumuri. This comparatively level depression is about 5 or 6 mi. in diameter and is dotted with picturesque estates and long avenues of royal palms. Through its center winds the beautiful Yumuri River, which finds an outlet at Matanzas through the vertical walls of a picturesque canyon. It is enclosed on all sides by steeply sloping walls rising 500 or 600 ft. to the level of a plateau out of which the valley has been carved. The Happy Valley, as it is called, is tempered by cool Atlantic breezes even on the hottest summer days.

CUBA, HISTORY OF. CHRISTOPHER COLUMBUS, who discovered Cuba on Oct. 28, 1492, believed that he had found a continent; the admiral's error was revealed when in 1508 Sebastian de Ocampo circumnavigated the island. Diego Velasquez, landing at Baracoa in 1511, began the work of conquest and occupation; by 1515 seven towns had been founded. The aborigines, impressed into the search for precious minerals and forced to work in the fields, were almost extinct by 1533; slave labor from Africa had been introduced a decade earlier. Feuds among the local authorities and the ravages of brigands checked the development of Cuba for more than a century. After the transfer of the island of Jamaica from Spain to England, many thousands of the Spanish residents emigrated to Cuba. Occupied by the British in 1762-63, after being returned to Spain (*see* PARIS, TREATY OF, 1763) Cuba was exempted from the more oppressive commercial restrictions of the Spanish colonial policy, and was more ably governed than were the colonies on the mainland. The island did not join in the series of revolutionary outbreaks, 1810-24, which ended Spanish rule on the mainland. During the periods when Spain was governed under the Liberal constitution of 1812, 1812-14 and 1820-23, Cuba was represented in the Spanish Cortes, and elected Provincial Congresses. The political education which the inhabitants acquired during these years made them fiercely resentful of the autocratic Government re-established in 1823. Conspiracies and insurrections flared intermittently, with increasing gravity, until the armed intervention of the United States in 1898.

Struggle for Independence. Mexican and Colombian intrigues for Cuban independence, following their own ventures into democratic government, were primarily important as an educational influence. French and English aspirations for the possession of Cuba, highly desirable from the point of view of naval strategy as well as for its economic resources, were restrained largely by the MONROE DOCTRINE. The attitude of the United States toward Cuba gave the Spanish Government greatest concern. Most Cuban revolutionaries desired annexation to the United States, as the archetype of republicanism. The con-

servative administration of President John Quincy Adams rejected overtures to support a Cuban insurrection; but as expansionist sentiment in the United States became identified with the slavery cause, leading Democratic politicians, supported by a great body of popular opinion in the southern states, openly proclaimed the annexation of Cuba as inevitable. Occasional filibustering expeditions sailed from southern ports to Cuba. In 1852-53 the BLACK WARRIOR CASE and its sequel, the OSTEND MANIFESTO, created a crisis between the United States and Spain which stopped just short of war. President Buchanan was publicly committed to annexation.

The response of Spain was, beginning in 1825, to invest in the governor-general of Cuba authority tantamount to that of martial law; suspects were imprisoned or exiled without trial, and liberties of the press and of assembly closely restricted. Members of the local councils were appointed and removed at the will of the governor-general; native Cubans were not enrolled in the military forces of the island. The expense of maintaining an alien army which usually mustered 25,000 men or more, a colonial navy, and the entire civil service of the island, in addition to providing an excess of revenue to be sent to the Spanish treasury, was borne by local taxation; bribery and malfeasance levied additional extortions. The accession of French exiles from Haiti and of motley vagabonds and adventurers, with increases in the number of free blacks and the importation of Mayan indentured labor from Yucatan and of Chinese coolies, diversified the life of the colony but provoked the Government to increasing severity as the price of order. The exclusive commercial policy, restored in 1829, promoted smuggling and other evasions. Occasional Liberal ministries in Spain were ousted by adherents of continued absolutism before colonial reforms could be effected. Widespread insurrection began in 1868; in 1878, by a combination of promises to extend the political privileges of the Cubans and to free certain classes of slaves with bribery of the revolutionary leaders, the Spanish authorities ended the Ten Years' War. By 1887 slavery was entirely abolished. The extension of political privileges, however, proved purely nominal. Certain reciprocity arrangements with the United States, begun in 1886 and enlarged in 1891, were canceled by Spain in 1894.

Maximo Gomez led the bloody insurrection which began in 1895; Tomás Estrada Palma and José Martí in New York headed a junta which rendered invaluable aid. The revolutionaries adopted a declaration of independence, July 15, 1895. Gen. Valeriano Weyler, sent from Spain to suppress the revolt, gathered some 400,000 noncombatants into camps (*reconcentrados*), where assumedly they would be unable to give aid and comfort to the rebels in the field. The occupants of the *reconcentrados* died in great numbers; humanitarian sentiment in the United States was aroused, and the intervention of the American Government was demanded. A Liberal

ministry came into power in Spain; but its grant of partial autonomy, while failing to appease the revolutionaries, incited reactionary Spaniards in Cuba, who fancied that American influence was responsible for the concession, to acts of violence against American nationals. The United States battleship *Maine* was mysteriously blown up at Havana, Feb. 15, 1898, with the loss of 260 men; this tragedy combined with other circumstances to bring about the SPANISH-AMERICAN WAR. In the peace treaty (see PARIS, TREATY OF, 1898) Spain relinquished control of Cuba; but the ultimate status of the island was left open. The Congress of the United States, in declaring war, had promised Cuba independence.

The Republic. Gen. LEONARD WOOD was military governor during a transitional era of two and a half years. A constitutional convention at Havana which convened in Nov. 1900, framed the document which, with the addition of the PLATT AMENDMENT, became the fundamental law of the new republic. The Civil Government of Cuba began on May 20, 1902. President Palma carried forward the work of hygiene and education begun during the American occupation. The Latin American tendency to violent factional conflict was soon manifested; Palma's reelection in 1906, marked by flagrant frauds at the polls, was the signal for a Liberal uprising in behalf of the defeated candidate, José Miguel Gomez. The United States intervened; Charles Edward Magoon headed a second Provisional Government, which was ended in Jan. 1909, after Gomez had been elected President in an orderly election. Extravagance and corruption in the national and local Governments gave rise to a revolutionary movement which subsided when the United States threatened another military intervention. Mario Garcia Menocal, a Conservative, was President from 1913-21; a Liberal uprising following his reelection, apparently by chicanery, in 1916, was subdued by the landing of American marines. Alfredo Zayas, Menocal's successor, served one term characterized by riotous corruption and financial mismanagement. GERARDO MACHADO, a Liberal, victor in the elections of 1924 and 1928, established a strong personal machine and ruled virtually as a dictator until after a revolutionary outbreak in Aug. 1931, when he consented to restore certain congressional prerogatives and to retire in 1933.

BIBLIOGRAPHY.—I. A. Wright, *Cuba*, 1910; H. H. Ver-rill, *Cuba, Past and Present*, 1914; C. E. Chapman, *History of the Cuban Republic*, 1927.

CUBAN LITERATURE, the literature of the Republic of Cuba, discussed under the heading, LATIN-AMERICAN LITERATURE.

CUBBERLEY, ELLWOOD PATTERSON (1868-), American educator, was born at Andrews, Ind., June 6, 1868. He graduated from Indiana University in 1891 and took his graduate work at Columbia. From 1891-96 he was professor and president of Vincennes University. The following two years he was city superintendent of schools in San Diego, Cal. In 1898 he went to Leland Stanford Jr. University

where he has been successively associate professor, professor and dean of the school of education. He was the director of the Portland, Ore., School Survey in 1913 and similar surveys in other cities. Among his writings are *Syllabus of Lectures on the History of Education*, 1902; *Changing Conceptions of Education*, 1909; *Rural Life and Education*, 1913; *A History of Education*, 1921; and *State School Administration*, 1927.

CUBE, a six-sided solid, hexahedron, each face being a square. If the edge is e , the volume is e^3 , and hence the third power of a number came to be called the cube of that number. See SOLIDS.

CUBE (Piper Cubeba), a climbing or sometimes tree-like evergreen of the PEPPER family native to the East Indies and cultivated in various tropical countries for its berries which are used in medicine. The dried unripe berries, which possess an agreeable aromatic odor and an acid pungent taste, are employed as a stimulant, expectorant and diuretic; they are also smoked in the form of cigarettes in the treatment of various respiratory affections.

CUBE ROOT, one of the three equal factors of a number, or an approximation to such a factor. For example, $27 = 3 \times 3 \times 3$, and hence the cube root of 27 is 3, written $\sqrt[3]{27} = 3$. In the case of 25 there exists no integral cube root, but there are such approximations as $\sqrt[3]{25} = 2.9, 2.92, 2.924, \dots$. Every number has three cube roots, one of which is real and the others complex. (See COMPLEX NUMBERS.) Thus, the cube root of 1 is 1, $-\frac{1}{2} + \frac{1}{2}\sqrt{-3}$, and $-\frac{1}{2} - \frac{1}{2}\sqrt{-3}$ as can be seen by cubing these numbers. See ROOTS.

CUBIC EQUATION, an equation of the third degree in the unknown quantity. The complete algebraic form is $ax^3 + bx^2 + cx + d = 0$. The solution of the equation in the forms $x^3 + ax^2 = c$ and $x^3 + bx = c$ was effected by TARTAGLIA, and in the general form by Cardan a little later, both in 1539. Cardan's solution was published in 1545. See EQUATIONS.

CUBISM, a movement in art most active during the period 1908-14. It derived chiefly from Paul Cézanne's conception of art as having an architectural basis and as being independent of the outside world. According to this point of view, the painter should take from nature only what would express his inner vision. Cézanne had died in 1906, and his use of color to produce form was ignored or misunderstood by the Cubists in their attempt to get as far as possible from nature and to create a pure, intellectualized art. They subjected even color to formal planes.

The Cubists approached their paintings like architects, desiring a formal and classical harmony without representing physical objects. Their ideal was "form, not forms." The symbols they used in pursuit of this effect were geometrical, such as the square, the triangle and the circle. The result was Flat-Pattern Cubism, the first phase of the movement.

In their revolt against illusionism they deliberately avoided introducing depth into their work. Later, when they understood the principles of Cézanne's art to a greater extent, the Cubists advanced to the use of the cube, the cylinder and the like, in the effort to combine the representational and the architectural in their symbolism. A still later phase was Expressionistic Cubism, represented by Fernand Léger, Metzinger, Laurens and Lhote. These endeavored to introduce a certain amount of feeling into the earlier purely abstract Cubism.

Futurism, an effort to paint noise and motion, was a derivative of Flat-Pattern Cubism. It began in Italy, where its sponsors were chiefly Boccioni, Depero and Severini. Vorticism and Synchronism were other derivatives, whose basic conceptions, however, were not the impersonal and abstract ones of Cubism.

The two most important names in Cubism were PABLO PISCASSO and Georges Braque. Others were Derain, Delaunay, Le Fanconner, Gleizes, Laurencin, Marcoussis, Picabia, Duchamp, Duchamp-Villon and Archipenko. After 1914, however, most of these painters broke away from the movement. A recent development is the movement of the Surindependents, led by Lurçat.

BIBLIOGRAPHY.—Ozenfont, *Art, Bilan des Arts Modernes en France*; Fry, *Cézanne, A Study of His Development*, 1927; Wilenski, *Modern Movements in Art*, 1927.

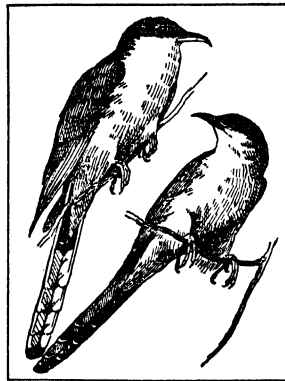
CUBIT, one of the world's primitive measures, the length of the forearm, or *ulna*, whence the English *ell* and the French *aune*. It varied considerably in length. The Egyptian and Babylonian cubits averaged about 20.6 in., while the Roman averaged about 17.4 in. Although not a legal measure, it is usually considered by English writers as 18 in. See WEIGHTS AND MEASURES, ANCIENT.

CUCKOO, the common name for a large family (*Cuculidae*) of birds of unusual habits found practically throughout the world but most numerous in the tropics. Cuckoos are generally of medium size with somewhat compressed, slightly arched bills, long tails and feet provided with two toes before and two behind. They vary greatly in form, plumage and habits, many species closely resembling or imitating unrelated birds, as hawks, pheasants or drongos. The call notes of most species are striking and in many cases have given rise to their popular names. A majority of the cuckoos build no nests of their own but deposit their eggs in the nests of other birds, leaving the task of hatching and rearing the young to the foster parents.

The European cuckoo (*Cuculus canorus*), widespread in Europe and Asia and wintering in Africa, is a notorious parasite. About a foot long, brownish above and barred with white below, it resembles a small hawk both in plumage and flight.

The best known North American species are the yellow-billed cuckoo (*Coccyzus americanus*) and the black-billed cuckoo (*C. erythrophthalmus*), both slender birds about a foot long, plain brown above and white below, the first found across the continent and

the second east of the Rockies. Unlike the European cuckoo, they usually build crude nests of their own and incubate and care for their young. They are of high economic value, destroying vast numbers of tent caterpillars and other injurious insects. Because



G. M. SUTTON. "BIRDS OF PENNSYLVANIA."
J. HORACE McFARLAND CO. COPYRIGHT

CUCKOO
Yellow-billed, left. Black-billed, right

of their peculiar call, thought to be indicative of approach of rain, these birds are sometimes called rain crows or rain doves. A. B. J.

CUCKOO FLOWER (*Cardamine pratensis*), a smooth perennial of the MUSTARD family, called also meadow bitter cress, grown as a garden ornamental. It is found in moist meadows and along brooks widely throughout Europe, Russian Asia and Arctic America extending southward to the northern United States. The erect stem, 1 to 2 ft. high, bears pinnately divided leaves and attractive bright white or rose-purple flowers, sometimes double, in a showy terminal cluster.

CUCKOO-PINT (*Arum maculatum*), called also lords-and-ladies, an acrid-poisonous perennial plant of the arum family, native to Europe and northern Africa and occasionally cultivated for its odd appearance. It grows about a foot high, bearing somewhat arrow-shaped leaves, and a long purple-spotted flowering spathe. This is constricted in the middle, enclosing a spadix bearing the small, purple flowers, which are followed by brilliant red berry-like fruits.

CUCKOO-SPIT, an English name for American "frog-spittle." The frothy bubbles often seen on grass blades and weeds, rarely on cultivated plants, are made by certain plant bugs (*Cercopidae*) popularly called spittle insects and frog hoppers. The adults are small, usually angular, squat bugs which when at rest suggest frogs ready to leap. The nymphs suck the sap of the host plant, and are completely surrounded with white froth. It has been thought that this afforded them protection from enemies. A more recent suggestion is that it protects their soft

bodies from the sun. Fluid is voided from the anus, and a mucilaginous substance from glands on the abdomen. Air bubbles are introduced with this mass from an air chamber beneath the abdomen, thus producing the white froth.

CUCUMBER, an annual, Asiatic, herbaceous prickly vine (*Cucumis sativus*) of the gourd family, cultivated since prehistoric times for its oblong succulent fruits. It is generally eaten as a salad though extensively pickled and to some extent cooked. Several closely related species are also grown, though much less widely, as the West Indian gherkin (*C. Anguria*); the snake or serpent cucumber, botanically a melon (*C. Melo*, var., *flexuosus*); the musk cucumber (*C. moschatus*), also known as cassabanana, and Mandra cucumber (*C. Sacleuxii*).

The common cucumber is a leading garden, field and greenhouse vegetable with dozens of varieties. It is tender to frost and must not be planted in the open until danger has passed. It delights in a warm location, a rich sandy loam and full sunlight. Insect foes are highly destructive to the young plants, and abundant seed must be sown to offset losses. The pests may be partially controlled by liberal doses of tobacco dust, by spraying with stomach poisons

CUCUMBERS, COMMERCIAL PRODUCTION, U.S.

4-Year Average, 1927-30

Division	Acreage	Production (Bu.)	% of Tot. Prod.
UNITED STATES	45,198	4,837,000	100.0
LEADING STATES:			
Florida	10,145	912,000	18.9
No. Carolina	5,045	575,000	11.8
So. Carolina	6,525	572,000	11.8
Alabama	3,068	433,000	9.0
Texas	4,440	388,000	8.0

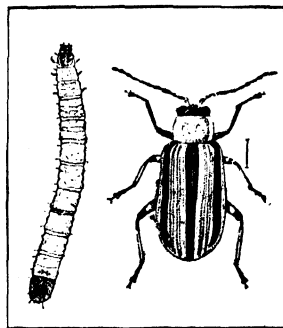
or by covering the plants, in private gardens, with fine mesh wire netting. After the plants develop their rough leaves the insects do less damage. The most important reason for protection is that the insects carry disease infection, especially wilt, from plant to plant. This disease is due to a bacterium (*Bacillus tracheiphilus*), and though preventable is incurable. Once having gained entrance to the tissues it propagates so rapidly that it clogs the stems and thus prevents the ascent of water from the roots to the leaves.

M. G. K.

CUCUMBER BEETLE, flea-beetles of the family *Chrysomelidae*. Two species are recognized, the striped yellow and black and the twelve-spotted yellowish green. The latter is also known as the southern corn root worm, because its larvæ are very destructive to the roots of young corn plants. Adult beetles eat the tender leaves of cucumbers, melons, squashes and pumpkins. Larvæ bore into the roots or stems of these plants, where they cause much damage. They pupate in the soil. Two broods may occur in the central and southern states. The striped species spreads bacterial wilt, which often destroys the vines suddenly. Adult beetles are a quarter to nearly half an inch in length. They are very active.

Protecting young plants with screens, sowing excess seed to offset damage, and planting trap crops to catch the larvæ are more satisfactory than poison.

CUCUMBER-TREE, a large species of magnolia (*M. acuminata*), called also mountain magnolia and cucumber magnolia. It is a fine forest tree, 60 to 90 ft. high, with a trunk 3 to 4 ft. in diameter, found from southern Ontario to Georgia and westward to Missouri and Arkansas, reaching its greatest size in the southern Appalachians. The tree is pyramidal in form, with rather small branches, bearing smooth, yellow-green leaves, 6 to 10 in. long; large bell-shaped, greenish-yellow flowers and oblong, often curved, dark red, cucumber-like fruit, about 3 in. long. The close-grained, durable, light brown wood, sparingly cut for lumber and known to the trade as yellow poplar, is used for flooring and cabinet-making.



COURTESY U.S. DEPT. OF AGRIC.

STRIPED CUCUMBER BEETLE

Right, adult beetle showing distinctive stripes. Left, larva

CUCUTA, a city of Colombia, and capital of the state of Santander Norte. Located near the Venezuelan frontier, on the transandean highway from Caracás, it is the chief trading center between the two republics. The products of the surrounding district are coffee and sugar cane. Some fields of cane have grown without replanting for 20 years, and require little cultivation. Pop. 1928, 49,279.

CUDAHY, a city in Milwaukee Co., southeastern Wisconsin, situated on Lake Michigan, 6 mi. south of Milwaukee. The Chicago and North Western Railroad serves the city. The surrounding country produces farm crops, while the principal industries of the city are meat-packing and the manufacture of rubber goods, vinegar and power and mining machinery. In 1929 the retail trade amounted to \$3,401,885. The city was settled in 1892 and incorporated in 1906. The rapid growth in population is due to industrial development. Pop. 1920, 6,725; 1930, 10,631.

CUDBEAR, a dyestuff derived from various lichens called *ARCHIL* and prepared in the form of a reddish powder.

CUDDALORE, a seaport in the South Arcot district of Madras, British India, on the South Indian Railway. Possession of Cuddalore was sought by the Maharattas, French and British from 1677 to 1785, when it was won by the British. Though a busy port, its shallow roadstead admits ships only to within a mile of the wharves. Weaving and dyeing are the chief industries, and cotton goods, oilseeds and sugar are the principal exports. Pop. 1921, 50,527.

CUENCA, the third city in importance in Ecuador, and the capital of the province of Azuay. It is connected, part by railroad and part by road, with Quito, about 180 mi. south. Situated at an elevation of 8,600 ft., Cuenca is perhaps the largest producer of Panama (Ecuador) hats in the world, reaching a value of nearly seven million *sucre*s (\$1,400,000) yearly. It manufactures woollens, sugar and pottery and exports Ecuadorian bark, cereals and hats. Cuenca is rich in marble, mercury, and gold mines as yet unexploited. It is the seat of a bishopric. Cuenca is a progressive, well-built municipality, with banks, automobiles, paved streets, hotels and thriving industries. It was founded in 1557 and has been the scene of important battles during the war for the independence of Ecuador. Est. pop. 1929, 50,000.

CUENCA, a city of east central Spain, capital of Cuenca province, situated on a mountain spur. It is poorly built, and is dominated by a fine Gothic cathedral. Once a busy town, making cloth and objects of art, the city is now industrially at a standstill. Nearby are the famous caves, *La Ciudad Encantada* or The Enchanted City. Est. pop. 1929, 16,000.

CUI, CÉSAR ANTONOVICH (1835-1918), Russian music composer, was born at Vilna, Jan. 18, 1835. A military engineer by profession, he devoted his spare hours to studying music with M. A. BALAKIREV, with whom he joined in demanding a hearing for native Russian music. As composer, critic and historian Cui was active in stemming the influence in Russia of Italian and German music and in fostering the movement for a national school of Russian music. His compositions include the operas *The Mandarin's Son*, *The Prisoner of the Caucasus*, and *Angelo*, 50 songs, 4 orchestral suites, and short pieces for violin and piano. He died at Petrograd, Sept. 3, 1918.

CULDEES (*Irish Ceile-De*, servant of God), members of a monastic institution which flourished in the British Isles, especially in Scotland and Ireland, from the 8th to the 12th centuries. The Culdees were originally hermits, but after a time adopted the community life though they never constituted a real religious order. Secular priests were later admitted and became canons of cathedral churches. The Danish wars wrought corruption and decay. Married laymen could be admitted and lay abbots often ruled the establishments. Gradually regular canons superseded them. The Irish Culdees antedated those in Scotland where, however, they were more numerous and between 750 and 1050 prominent in religious and political affairs. The last Scottish Culdees, at St. Andrews, disappeared before the Reformation. In Ireland, the

Culdees at Armagh survived until about 1603. The only houses in England and Wales were active at York in the 10th and at Bardsey in the 12th century.

CULIACAN, a city of western Mexico, and capital of the state of Sinaloa, situated on the Culiacan and Humaya rivers, about 37 mi. from Altata, the port on the Gulf of California. It has an elevation of 1,119 ft. above sea level, and is known for its clean streets, good buildings, modern schools, quaint *portales* and massive cathedral, erected in 1855. Many kinds of tropical fruits are found for sale here and great beds of luscious oysters lie beyond the mouth of the river. The plaza, Jardin Rosales, in the lower part of the city along the river, has shady walks and driveways, bordered by flowers. The surrounding country is rich in Nahuia Indian relics, such as stone axes, pottery, and arrowheads. The official name of the city is Culiacan Rosales, in honor of the patriot and military general, Victor Rosales. When the Spaniards founded the city in 1530 they called it San Miguel. Pop. 1930, 68,532.

CULLEN, COUNTIEE (1903-), American Negro poet, was born in New York City, May 30, 1903, and graduated at New York University, 1925, and at Harvard University in 1926. From 1926-28 he helped to edit *Opportunity—Journal of Negro Life*. He was granted the John Simon Guggenheim Fellowship for 1928-29. Cullen is author of *Color*, 1925, *Copper Sun*, 1927, *The Black Christ and Other Poems*, 1929, and *One Way to Heaven*, 1932.

CULLEN, WILLIAM (1710-1790), Scottish physician and medical instructor, was born at Hamilton, Lanarkshire. After taking a medical course at the University of Edinburgh, he practised at Hamilton and Glasgow. He was instrumental in founding the medical school in Glasgow and held the chair of medicine and of chemistry at both Glasgow and Edinburgh. He was an inspired teacher and the inventor of the system of hydrotherapy called "Scotch douche." His textbook "First Lines of the Practice of Physic" was for years an authoritative textbook much used in the United States.

CULLEN, SIR WILLIAM PORTUS (1855-), Australian statesman, was born at Mount Johnston, Jamberoo, New South Wales, May 28, 1855. He graduated from Sidney University with high honors, began practicing law in 1883 and from 1891 to 1910 served successively in the legislative Assembly and Council. In 1910 he was elected lieutenant-governor of New South Wales, and in 1910-25 was chief justice. He also acted as vice chancellor of Sidney University in 1908-11 and in 1914 became chancellor.

CULLODEN MOOR, BATTLE OF. This was the final incident in the last attempt of the Stuarts to regain the throne. Under CHARLES EDWARD, the "Young Chevalier," a Scots army, 7,000 strong, weakened by hunger and wearied by a long night march over the moors, was wiped out by an English army under the Duke of Cumberland, Apr. 16, 1746. Discipline and the better handling of artillery seem to account for Cumberland's success and the savagery

with which he followed up his victory earned him the name "the butcher."

CULLOM, SHELBY MOORE (1829-1914), American lawyer and statesman, born in Wayne Co., Ky., on Nov. 22, 1829. The Culloms moved to Illinois in 1930. The boy attended grammar school and for two years the Rock River Seminary at Mt. Morris. In 1853 he began to study law at Springfield, and was admitted to the bar in 1855. Elected city attorney in the same year, he began an unbroken political career of more than 50 years. In 1856 he was elected to the state legislature. He was a member of the lower house of the legislature in 1860-61, 1872 and 1873-74, serving as speaker in 1861 and 1873. He sat in the House from 1865 to 1871, was governor of Illinois during 1876-83, and was United States Senator in 1883-1913. He was defeated for reelection to the Senate in 1912. The Cullom Report of 1886 provided much of the data on which was based the Interstate Commerce Commission act of 1887. He died on Jan. 28, 1914.

CULMINATION, the passage of a heavenly body through the highest or the lowest point reached during its daily motion in the sky, coinciding with its passage through the MERIDIAN.

CULTIVATED PLANTS. Cultivation of plants began in prehistoric time and has since been a dominant factor in molding and directing the course of civilization and history. It apparently arose as an effort to insure a food supply under adverse conditions, since prehistoric remains give evidence that food plants were cultivated first, followed by fiber plants and later by other types.

Almost every inhabited land has furnished native plants for domestication and cultivation, but the more important ones have come from rather restricted areas. These accompanied primitive man in his migrations or were adopted by neighboring tribes, so that many cultivated species attained wide distribution even in early times. The development of commerce following the discovery of America and the opening of the East Indian trade added to the number of cultivated plants and greatly stimulated cultivation by providing a market for excess production. Since that time comparatively few plants of importance have been introduced into cultivation, while more effort has been directed to improving the quality and productivity of established species. This is merely accelerating a process which had been carried on for centuries in selecting the most desirable plants for propagation and which has resulted in great changes in the plants themselves. A remarkable example is the development, mostly in the last 2,000 years, of cabbage, kale, kohlrabi, cauliflower, broccoli, and Brussels sprouts from a single wild species. While the wild forms of many cultivated plants are known, the origin of others is still unknown, the wild forms being now extinct or the cultivated plants so changed that their relation to a wild ancestor is no longer apparent.

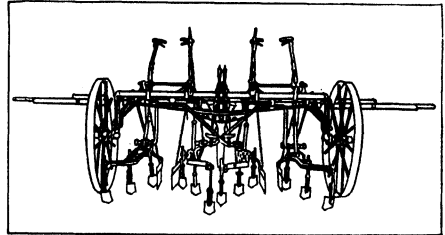
The families of plants have contributed very unequally to cultivation. Our cereals, such as corn,

wheat, rye, rice, oats, and barley, as well as sugar cane, are grasses. Starchy foods are not furnished by other plants on an equal scale, except by the potato of the nightshade family and the cassava of the spurge family; in the production of sugar the only rival of sugar cane is sugar beet. Numerous cultivated plants belong to the bean family, including clover, alfalfa, peanut, pea, and bean. The rose family is noted for its fruits, including apple, pear, quince, cherry, plum, peach, almond, apricot, raspberry, blackberry, and strawberry. Drugs, fibers, vegetables, ornamental plants, and other fruits are produced by many different families.

Although the Americas are rich in plants of potential economic value, it has generally been easier to introduce the well-known species of the Old World than to improve the quality of the American plants. The Americas have therefore furnished only a small proportion of the important cultivated plants of the world. Of these the most valuable commercially and most widely used are Indian corn, potato, tobacco, and Pará rubber; others worthy of mention are Lima bean, garden bean, cacao, cassava, cinchona, certain varieties of cotton, American grapes, peanut, pineapple, pumpkin, squash, sisal, sweet potato, tomato, and vanilla. Excepting the grape, all of these are tropical or subtropical in origin and were mostly in cultivation or use by the Indians before the discovery of America.

H. A. G.

CULTIVATORS, machines used to break up the surface of the soil and to destroy weeds. They usually consist of a frame carried on wheels and equipped with movable gangs to which are attached a set of



TWO-ROW HORSE-DRAWN CULTIVATOR

small shovels or sweeps. The types include the small garden cultivator, manually operated, the one and two-row riding horse drawn cultivators, and the two and four-row tractor cultivators.

CULTS. The reverence for some power considered supernatural and the performance of ceremonies in its honor are almost universal among primitive peoples. The object of a cult is not necessarily thought to be a god but to radiate power which can be received and handled only by those fitted for it through the proper ceremonies. Such power may be ascribed to almost anything which has assumed prominence in a people's life. The Toda of India have a cult of the buffalo whose dairy products furnish

their food supply. The Ashanti of Africa practise an ancestor cult and the American Indians of the Plains practise a cult of guardian spirits who assist them in war. Other cult objects include the salmon, bear, bull, fire, heavenly bodies and, in more advanced societies, spirits and gods. Several such cults may exist together, according to the forces in which a people believes. See **RITUALISM**.

CULTURE AREA. In studying the life of primitive peoples, it becomes obvious that certain inventions and practices are used widely over one geographical area, that they dwindle toward its outskirts and, in a neighboring area, are replaced by a set of different practices and inventions, i.e., a culture. Thus, on the northwest coast of America the Indians excel in the use of wood for houses, in carving and for canoes. They keep slaves and have a system of rank and give away property at huge feasts. On the other hand, they have no pottery and little basketry and weaving. In the Southwest the Indians have no wood. They keep no slaves, have no conception of rank and no donation feasts, but make beautiful pottery, textiles and baskets. These, with other differences, constitute two regions with separate culture areas. Any country at any date can, after sufficient study, be divided in this way.

CULTURE CENTER. The characteristics of a CULTURE AREA are not evenly distributed over a region. They reach their highest development at one point and thin out in every direction until, at the margins of the area, only a few elements of the typical culture can be found. It is assumed, therefore, that usages originated at this highest point and then spread, in diminishing waves, to the outskirts. Thus Mexico and Peru are considered to have been the culture center for the two Americas which show traces of their arts but in an elementary and incomplete form. The rule does not hold rigidly but is a useful working hypothesis.

CULVER CITY, a residential suburb, eight mi. west of Los Angeles, in Los Angeles Co., southern Cal. Moving picture studios afford the chief industry of the community. Pop. 1920, 503; 1930, 5,669.

CULVER MILITARY ACADEMY, an institution for secondary education for boys at Culver, Ind. It was founded in 1894 by Henry Harrison Culver on the 1,000 acre Culver estate on Lake Maxinkuckee. The academy arranges its courses to meet the varying entrance requirements of more than 50 colleges. Its military work has received the highest rating by the United States War Department.

CULVER'S-ROOT (*Veronica virginica*), called also Culver's physic, an herbaceous perennial of the fig-wort family, sometimes cultivated for ornament. The plant is found in moist soils from Ontario to Manitoba and southward. It grows from 2 to 7 ft. high, with finely toothed, lance-shaped leaves and small white or pale blue flowers, in narrow, erect clusters. The thick, blackish, bitter root, which contains the glucoside leptandrin, has long been used in medicine.

CULVERTS, a term commonly used to refer to structures which provide water-ways beneath roadways or through earth embankments. There are many forms of culverts, including vitrified clay pipe from 12 inches to 24 inches or more in diameter; cast iron pipes up to 4 feet in diameter; corrugated metal pipes; concrete pipes up to 8 feet in diameter; re-enforced concrete box culverts of rectangular or square cross section, and culverts of brick, stone or concrete built in the form of an arch.

CUMAE, an ancient town of Greece in Italy, is on a volcanic hill in Campania 14 mi. west of Naples. Perhaps dating from as early as 1050 B.C., Cumae has been called the most ancient Greek settlement in Italy. Its commercial importance was large and its power tremendous; Naples, Puteoli and other towns were colonies of Cumae. In 474 B.C. Cumae's fleet destroyed that of the Etruscans, but in 420 the Samnites took the city, and in 337 it came under Roman rule. Cumae is said to be the birthplace of the Roman alphabet. One of the vast caves beneath the hill was the traditional abode of the Cumaeen Sibyl. Extensive ruins have been found.

CUMBERLAND, a city of northwestern Maryland, the county seat of Allegany Co., situated on the Potomac River, about 135 mi. northwest of Baltimore. It is served by airplanes, bus and truck lines, the Baltimore and Ohio, the Western Maryland and the Pennsylvania railroads, and by the Chesapeake and Ohio Canal, of which it is a terminus. Cumberland is beautifully located in the heart of the Allegheny Mountains, which are cut here by a gorge called the Narrows. In the surrounding hills are caves, mineral springs and also an important coal-mining district, for which the city is a trading center. Near by is a rich fruit-growing region. The chief local manufactures are artificial silk, rubber tires and tubes, having a value in 1929 of \$37,949,536. In 1929 the retail trade reached a total of \$21,213,181. Among the interesting landmarks are the site of old Ft. Cumberland and a log cabin once occupied by George Washington.

Old Ft. Cumberland was built by the British in 1755 and named for the Duke of Cumberland. This fort was the base of operations of Gen. Braddock and Col. Washington in the French and Indian War. The town was laid out in 1785 and was officially named Cumberland two years later. In 1850 it became a city. Pop. 1920, 29,837; 1930, 37,747.

CUMBERLAND, a town of northeastern Rhode Island, on the Blackstone River, about 6 mi. north of Providence and 2 mi. from Pawtucket. It is served by the New Haven Railroad and by motor bus lines. The principal crop is garden truck, and the principal manufactures cotton goods, silk and mohairs. The retail business in 1929 amounted to \$1,428,318. The only Cistercian Monastery in the eastern part of the United States is located here. The town was first settled in 1635 by Rev. William Blackstone, founder of Boston, Mass. Pop. 1920, 10,077; 1930, 10,304; about 10% were foreign-born.

CUMBERLAND MOUNTAINS, a division of the Appalachian system in eastern United States, extending from the eastern boundary of Kentucky southward through Tennessee into Alabama. They include the Cumberland escarpment, varying from 2,000 to 3,000 ft. in height, which forms the steep eastern facing of the Cumberland plateau, and the valley ridges just east of the escarpment. The Cumberland plateau, sloping gently northward toward the interior plains, is a continuation of the Allegheny plateau in West Virginia, Virginia and Pennsylvania. This mountain region is deeply eroded by streams, well-timbered with chestnut, pine, hickory, oak and maple and has rich deposits of coal and iron. It was once the stronghold of the moonshiners and the theater of violent feuds between the primitive mountain folk. To-day in the remote regions there are many people living still in the same stage of civilization as the original settlers. Where Kentucky, Tennessee and Virginia meet is the Cumberland Gap, a pass about 500 ft. deep, which was the doorway through which the pioneers emigrated to Kentucky and Tennessee. These mountains give rise to both the Tennessee and Cumberland rivers.

CUMBERLAND PARK, a state park at Pineville in Bell Co., southeastern Kentucky, created in 1925. The park, situated in a region of great scenic beauty, contains 2,000 acres including a 35-acre lake.

CUMBERLAND RIVER, one of the largest tributaries of the Ohio, formed by the junction of the Poor and Clover forks in Harlan Co., Kentucky. This river flows westward to Burnside, Ky., from whence it makes a loop south into Tennessee and upon reentering Kentucky flows northward to empty into the Ohio River near Smithland. Throughout its length of 687 mi. it has a slope of over 800 ft., the greater part of which is in its upper course. In Whitley Co. the river has a vertical fall of 63 ft., above which it is a typical mountain stream of little volume in dry months and is chiefly noted for its scenic beauty. Its basin of 18,573 sq. mi. is diversified by timberland and farming areas. Nashville, Tenn., is the largest city on its course. Open channel projects carried out by the United States government have provided for navigation from the mouth of the river to Burnside, a distance of 518 mi. In 1929 it transported cargoes aggregating 314,649 tons.

The Cumberland region was the scene of many conflicts during the Civil War. Fort Donelson was built on its bank by the Confederates and its capture by General Grant in Feb. 1862 was one of the decisive actions of the war.

CUMBERLAND ROAD or **NATIONAL PIKE**, a highway from Cumberland, Md., to Vandalia, Ill., constructed and maintained by Federal appropriations. It was the first such work to be undertaken by the National Government, and consequently the concrete issue in controversies over the constitutional authority of the Government to finance internal improvements. Authorized by Congress in 1806, the road was begun in 1811 and in 1818 completed to

Wheeling. After an interim because of the reluctance of President Monroe to approve appropriations for internal improvements, construction was renewed in 1825. Though the road was originally designed to reach the Mississippi, grading was carried no farther than Vandalia. In 1838 Congress made its final appropriation for the work, and title to the road passed to the states which it traversed. Until the Baltimore & Ohio reached the Ohio River in 1852, the Cumberland Road was an important artery of pioneer emigration and local commerce; stage coaches, CONESTOGA WAGONS and numerous wayside taverns were components of a unique glamour.

CUMIN (*Cuminum Cuminum*), a dwarf, fennel-like plant of the PARSLEY family grown for its aromatic seeds sparingly used for flavoring, like ANISE and CARAWAY. It is a smooth, slender annual with very finely cut leaves and small white flowers, native to the Mediterranean region.

CUMMINS, ALBERT BAIRD (1850-1926), American statesman, was born at Carmichaels, Pa., Feb. 15, 1850. He attended college at Waynesburg, Pa., where he studied engineering but later gave this up in favor of law. He studied in Chicago and in 1875 was admitted to the bar. In 1878 he moved to Des Moines with his wife whom he married in 1874, and after an active political career as a member of several Republican National Conventions he became Governor of Iowa from 1902-08. From 1908-26 he was a member of the U.S. Senate and in 1923 was president of that body. He died at Des Moines, July 30, 1926.

CUNARD, SIR SAMUEL (1787-1865), English shipowner, was born Nov. 21, 1787, in Halifax, N.S., where he was for many years a merchant and the owner of a fleet of whaling vessels. He conceived the idea of a fast mail service between England and America and, in 1839, bought four steamships and made a seven-year contract with the British government at £60,000 annually to operate a mail service by steam rather than sailing ships. The first trip was made in July 1840, Liverpool to Boston, in fifteen days. This Royal Mail Steam Packet Co. was the forerunner of the Cunard line, one of the world's foremost ocean transportation organizations. Cunard died in London, Apr. 28, 1865.

CUNEIFORM (Wedge-Writing), a syllabic script employed as a means for writing on stone and clay by the Sumerians, Babylonians, Assyrians, Elamites, Persians, Kanisians and others. It developed from the PICTOGRAPH and underwent two stages, the first consisting mostly of ideograms (*see* IDEOGRAM), while the second employed both ideograms and syllables. With the development of syllabic script the reading necessarily grew more complex, since a given sign might represent an ideogram, a determinative, or even one of several syllabic values (polyphony). Cuneiform writing is in use until the 1st century A.C.

BIBLIOGRAPHY.—B. Meissner, *Die Keilschrift*, 1913.

CUNEO, a city of Italy, capital of the province of the same name in the extreme southeast of the valley of the Po in Piedmont, not far from the French fron-

er. In an imposing Alpine setting, the city has a spacious square and some fine churches and palaces. Industries include textile manufacture and there is a risk trade in agricultural products, chestnuts and ocons. Pop. 1931, 36,150.

CUNHA, EUCLYDES DA (1866-), Brazilian poet, was born Jan. 20, 1866, in Santa Rita do Rio Negro, municipality of Cantagallo, and was educated in Rio de Janeiro. At the Escola Militar da Praia Vermelha he laid the foundations of his scientific studies; later he studied engineering at the Escola Polytechnica of Rio, but returned to the Army on the proclamation of the Republic. He made the traditional beginning with a collection of verses entitled *Ondas* (*Waves*). In 1888 he became a journalist, and while collaborating on the newspaper, *Estado de São Paulo*, he gathered the material which he was to incorporate in his one famous work, *Os Serões*. During the presidency of Prudente de Moraes, 1895-98, there was an uprising of the *seranejos*, or inhabitants of the Brazilian hinterland, and da Cunha went into the wilderness to report the campaign of the Government against the rebellious inhabitants of the *serão*. His book appeared in 1902; the following year he was elected to the Brazilian Academy of Letters. With *Os Serões*, da Cunha not only discovered the interior of Brazil to the Brazilians; he revealed as well the psychology of a regional type.

CUNLIFFE, JOHN WILLIAM (1865-), American educator, was born in Lancashire, Eng., Jan. 20, 1865. He graduated from the University of London in 1884, taking his M.A. there in 1886 and his D. Litt. in 1892. Cunliffe lectured in English at McGill from 1899-1906 and was professor of English at the University of Wisconsin from 1906-12. From 1912-1920 he was associate director of Columbia University School of Journalism and from 1920-1931, director. His writings include critical studies on drama and poetry and the compilation, *Century Readings in European Literature*, 1925. He also edited several Elizabethan plays and contributed to many literary publications.

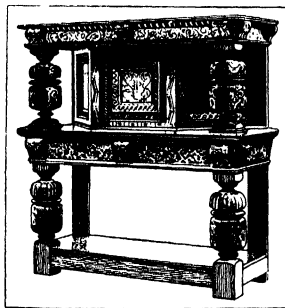
CUNNINGHAM, WILLIAM (1849-1919), British historian, was born in Edinburgh Dec. 29, 1849. He was educated at Edinburgh Academy and University and Trinity College, Cambridge. He was a professor at King's College, London, 1891-97; lecturer in economic history at Harvard University, 1899; vicar of Great St. Mary's, Cambridge, 1887-1908, and became archdeacon of Ely in 1907. Cunningham died at Cambridge, June 10, 1919. His first and major work, *Growth of English Industry and Commerce*, appeared in 1882. It has since gone through six editions and revisions and is still the standard work on the subject. In addition to his major work he wrote: *Uses and Abuses of Money*, 1891; *Western Civilization in its Economic Aspects*, 2 vols., 1898; *Modern Civilization; Rise and Decline of Free Trade; Case Against Free Trade*, 1910; *Christianity and Politics*, 1915; *Progress of Capitalism*, 1916.

CUNNINGHAME GRAHAM, ROBERT BONTINE (1852-), Scottish politician and author, was born in Scotland in 1852, and educated at Harrow. After spending several years in cattle farming in the Argentine and traveling extensively, he represented North Lanarkshire in Parliament in 1886-92; in 1918 he represented Stirlingshire. His various writings include *A Vanished Arcadia*, 1901, *Life of Hernando de Soto, Success, Life of Bernal Diaz del Castillo, The Conquest of New Granada, The Conquest of the River Plate, Doughty Deeds*, 1925, and *The Horses of the Conquest*, 1930.

CUNO, WILHELM (1876-), German statesman, was born at Suhl, in Thuringia, July 2, 1876. During the World War he held high offices in the grain and food departments. Cuno left the service in 1917 to join the board of directors of a trans-Atlantic steamship line, being made general director the next year. An active member of the Center Party, he formed a non-party Cabinet in November 1922, and became chancellor. After his forced resignation, Aug. 1923, he again became head of the steamship line.

CUPAR, a royal burgh and county town of Fifeshire, Scotland, situated on the Eden in the east of the Howe or Hollow of Fife, about 31 mi. northeast of Edinburgh. An ancient town closely associated with Scottish royalty and history, few relics survive. Where the 12th century castle of the Macduffs once stood there is now a public school, and before it is the "Playfield" where MORALITIES once were produced. Fine printing is done at Cupar, which also makes linen, and leather, and has beet-sugar refineries. Pop. 1921, 4,146; 1931, 4,596.

CUPBOARD, the name originally applied to a board or shelf for cups, but later applied to the whole

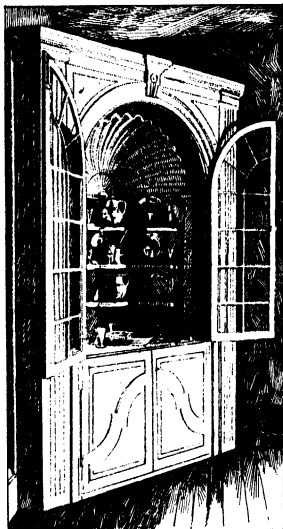


COURTESY M. M. OF ART

ELIZABETHAN COURT CUPBOARD OF OAK,
CARVED AND INLAID
Late 16th century

piece of furniture of which the shelf was a part; thus denoting a closet with shelves for cups, dishes, food or other articles. The cupboard evolved from the CHEST at the stage when the lid of that piece was replaced by doors in front. In this early form it was often

used as a washstand. By a gradual enlargement it became the court cupboard of the Tudor period, an ornate piece having two tiers of cupboard doors below and a set of open shelves above for the display of plate. Many other types of cupboard have existed, each being named from its use or construction. There



COURTESY M. M. OF ART

18TH CENTURY AMERICAN CORNER CUPBOARD OF PINE FROM CONNECTICUT

are food cupboards, livery cupboards for use in servants' quarters or in bedrooms at night, press cupboards for linen and clothes, serving cupboards or CREDENZAS, dole cupboards for church charity, corner cupboards, hanging cupboards and built-in cupboards.



COURTESY M. M. OF ART

EROS, OR CUPID, BEFORE AN ALTAR

From a Greek lekythos, or oil jar, of Athens (500-475 B.C.)

The decoration of cupboards has varied with the changing decorative styles. The early Gothic motifs were expressed in some, as was later the architectural classicism of the Italian Renaissance. The inlaid floral patterns developed by the Dutch and Flemish artists, the flamboyant gilded carving of the Louis XIV period, the fantastic lacquer painting in the Chinese manner, all had their turn in the decoration of the useful cupboard.

CUPID, the Roman god of love, is of later date than the Greek counterpart, EROS, and is most familiar

not as a man, but as a boy attending on his mother, VENUS, and mischievously wounding the human heart with his arrows. (See PSYCHE.) The name is attributed to the word, *cupido*, meaning desire. Cupid's bow is a phrase frequently used by poets.

CUPOLA, in metallurgy, a steel stack lined with fire brick, used for melting iron. Coke is charged in alternate layers with iron, filling the furnace to the charging door located some 15 ft. above the bottom. After igniting the bed coke, an air blast is admitted through openings spaced around the shell near the bottom. Molten iron is drawn off near the bottom into a ladle and carried to the molds. Good practice demands metal of the correct temperature and composition, the minimum of fuel, and continuous operation without clogging up. Better efficiency and quality has resulted from heating the blast with the waste gases, better fluxes, and the use of coke with a slower rate of combustion. Cupola efficiency is only about 50%, but it is still the cheapest and fastest method of melting iron. S. R. R.

CUP-PLANT (*Silphium perfoliatum*), a stout, resinous, perennial of the composite family, called also Indian-cup. It grows in rich soil from Ontario to South Dakota and southward and is sparingly cultivated for ornament. The square stem, 4 to 8 ft. high, bears large, coarsely toothed leaves and showy heads of yellow flowers in large clusters. The upper leaves are united by their broad bases to form a cup-like cavity from which the plant derives its name.

CUPRAMMONIUM SILK, a product of a process of synthetic yarn manufacture, in which purified cotton linters are dissolved in a solution of copper hydroxide in strong aqueous ammonium hydroxide (Schweizer's reagent). This viscous cuprammonium cellulose solution is filtered, deaerated, and forced through rather large spinnerets into warm water, which removes some of the ammonia and partially coagulates the cellulose as filaments of rubber-like consistency. The spinneret is located in a "spinning funnel," through which the coagulating water flows. This funnel is narrower at the bottom and, as the water flows more rapidly through the narrow outlet, it stretches the rubber-like, partially-coagulated filaments, whereby finer filaments are obtained. The filaments are hardened by passing through a sulphuric acid solution, after which they are collected and twisted together to form the yarn. Skeins of yarn are treated with sulphuric acid solution to remove the copper present, bleached, washed, oiled, inspected and sorted into grades, and wound into packages for use. The final yarn consists of regenerated CELLULOSE. Its dyeing, chemical, and other properties, except appearance, closely resemble those of mercerized cotton. Fifteen denier, 25-filament cuprammonium yarn is the finest filament commercial synthetic yarn. The filaments are about 2.5 times finer than those of natural silk and 4,227 miles of this single filament weighs a pound. See also CELLULOSE ACETATE; CELLULOSE PRODUCTS; YARNS, SYNTHETIC. C. E. M.

CUPRA SILK. See CUPRAMMONIUM SILK.

CUPRITE, an ore of copper, also called ruby copper. It is often carmine but may vary in color through brown to nearly black. Cuprite is named from *cuprum*, Latin for copper. It is a copper oxide crystallizing in the ISOMETRIC SYSTEM, and is found

crystallized, earthy, massive, and in hair-like aggregates. Cuprite is a common mineral of the oxidized zone of copper sulphide deposits, the WEATHERING and oxidation of other copper minerals producing it. Buried copper coins and utensils sometimes show it. Cuprite is found in copper mines in Cornwall, France, abundantly in Chile, Peru and Bolivia, and in the copper camps of Arizona. See also ORE DEPOSITS.

CURAÇAO or **CURAÇOA**, an island in the Dutch West Indies, the largest of the group known under that name. Lying about 40 mi. from the Venezuelan coast, it has an area of 212 sq. mi. Its length is about 40 mi. and its maximum breadth about 10 mi. Hills in the southwest about 1,000 ft. above sea level relieve the otherwise level topography. The island is surrounded by reefs and has many natural harbors, the largest being St. Anna on the south. Beans and maize are grown in the lowlands of the interior, but cotton, cacao and tobacco are the chief agricultural products. Venezuela and the United States buy most of Curaçao's cattle and phosphates. The chief industries are oil refining and weaving of straw hats. Willemstad, with a population in 1929 of 20,792, is the largest town and the capital of the Curaçao group of Dutch islands which include Bonaire, pop., 1929, 13,450, area 95 sq. mi.; Aruba, pop., 5,375, area, 69 sq. mi.; St. Eustatius, pop., 965, area, 7 sq. mi.; Saba, pop., 1,408, area, 5 sq. mi. and the southern part of St. Martin comprising an area of 17 sq. mi. with a population of 2,180. This group of islands is administered by a Dutch governor and a council composed of a vice president and three members appointed by the Dutch crown. A delicate orange liqueur known as curaçao had its origin in the island of Curaçao. Pop., 1929, 44,344.

CURASSOW, a group (*Cracinae*) of gallinaceous birds comprising some of the finest game birds of South America. They are often nearly equal to a hen-turkey in size, with habits somewhat resembling those of the domestic fowl but more arboreal. In appearance the various species are quite similar, the males being black above, somewhat glossed with purple or dark green and white below, with a large somewhat curled crest on the head. They usually go in flocks and inhabit high trees where they build bulky nests in which they lay white eggs. Some species breed readily in captivity. One of the best known is the crested curassow (*Ciax elector*), abundant in the forests of French Guiana.

CURATE, in the Roman Catholic and Anglican churches, a priest to whom the cure of souls in a particular district is intrusted; particularly a clergyman who performs his duties under the supervision of a bishop or rector. A curate is an assistant to the priest in charge. In France the *curé* is the pastor, and the *vicaire*, the assistant.

CURB, an edging of stone or concrete bordering the pavement of streets. It is so set that its top is near the level of the sidewalks. Its face limits the travel of vehicles on the pavement and holds rain water in the gutters. Curbing commonly consists of

blocks of granite or other hard stone 6 inches or more wide, 12 to 24 inches deep, and 4 inches to 10 feet long. The blocks are set in a foundation of concrete.

CURB MARKET, a securities market originally conducted in the open air and originally unorganized but today, in most cases, organized and housed. In Amsterdam, the first stock market in Europe was originally conducted in the open air. At the present time the curb market provides a market place for securities whose earning and development periods are in prospect. The New York Curb Exchange is the second largest securities market in the United States. Securities of many of the oldest and most stable corporations in the world, such as the Standard Oil, are found on its trading list. Here are offered, too, the Stocks of the industries of the future, some of which are eventually graduated to the list of the New York Stock Exchange. The Boston Curb Exchange, which is now housed, deals principally in mining shares. With the transference of the center of the financial world from London to New York after the World War the New York Curb market has become an important feature of the nation's financial activities and is now international in scope.

CURCULIO, a term applied to snout-beetles of the family *Curculionidae*. These beetles feed on foliage, fruits, seeds and nuts. From an economic viewpoint, one of the most important is the plum curculio. It attacks all stone fruits, often making a large part of the crop wormy and worthless. The small dark brown adults appear from hibernation in the early spring. They feed at first upon foliage, later upon blossoms and young fruits. Eggs are laid in the young fruits. Here the white grubs develop and feed. Leaving the fruit, they pupate in the soil. Beetles emerge by July or earlier. Two broods occur in the southern part of the range. Spraying with lead arsenate when the leaves first appear will destroy the adults. Hogs and poultry destroy both adults and pupæ.

CUREL, FRANÇOIS, VICOMTE de (1854-1928), French dramatist, was born at Metz, June 10, 1854. His first field in literature was fiction, but he subsequently turned his attention to the stage, where he achieved outstanding distinction. His plays are somewhat somber in tone, and are frequently built around abstract themes, such as science, capital and labor, but all are distinguished by the vigor and brilliancy of their style. His best known plays are *The Other Side of a Saint*, 1892, and *The Fossils*, 1900. He died at Paris, Apr. 26, 1928.

CURFEW, from the French *couvre-feu*, "cover fire," the medieval custom of ringing a bell at a certain hour of the evening as a signal for citizens to cover their fires and go to bed. In former times this practice, which William the Conqueror is said to have introduced into England for political reasons, was necessary as a police measure to prevent fires in the over-crowded towns. The curfew bell still rings in certain parts of England and the United States.

CURIA, a division of a tribe in Roman history. The origin of the curiae is one of the most confused problems of Roman antiquity. Whether the 30 curiae divided into three tribes of ten curiae each, were formed on a geographical basis as is now generally believed, or on religious connections among the early peoples of the hill cities, or whether or not the **PLEBS** were included in this grouping, it is clear that they were bound together in common religious beliefs, each with its own priests and altars. The curia was the basis of the first assembly, *comitia curiata* (see **COMITIA**).

CURIA ROMANA, an ecclesiastical term, which signifies the papal government of the Catholic Church, maintained in **VATICAN CITY**. The word *Curia*, here used in the original Latin, has been modernized throughout the world as "court."

CURIE, MARIE SKŁODOWSKA (1867-), Polish-French physicist and chemist, was born at Warsaw, Nov. 7, 1867. After studies with her father, a physics professor in the University of Warsaw, she went to Cracow and later to the Sorbonne, Paris, where she met **PIERRE CURIE** and married him in 1895. She obtained her doctorate in 1903, and in the same year became an assistant in her husband's laboratory at the Sorbonne. After his death in 1906 Madame Curie succeeded him as professor at the Sorbonne, the first woman to hold such a position at the university. When the Radium Institute was formed she was appointed head of the research laboratory, and later established a radiological laboratory in Warsaw. After her marriage she collaborated with her husband in the researches on radioactivity which resulted in their discovery of polonium and radium, for which they were awarded, jointly with Henri Becquerel, the Nobel Prize in physics in 1904. She continued the investigations alone and succeeded in isolating the element radium as a metallic substance. The results of her work she embodied in the *Traité de Radioactivité*, published in 1910, now a scientific classic. The following year she was awarded the Nobel Prize in chemistry. During the World War she was active in hospital work.

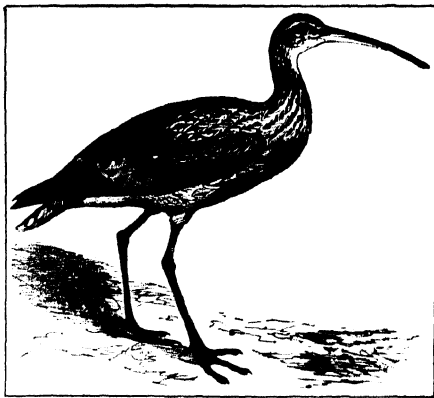
CURIE, PIERRE (1859-1906), French physicist, was born at Paris, May 15, 1859. He obtained his doctorate in 1895 at the Sorbonne, where he was appointed to the chair of physics in 1904. His early scientific work was done in collaboration with his brother, also a physicist, with whom he discovered the phenomenon known as piezo-electricity. The discovery by Henri Becquerel in 1896 of the radioactive properties of uranium led him to undertake studies in radioactivity in collaboration with his wife, **MARIE SKŁODOWSKA CURIE**. In 1898 they discovered the element polonium, and later the same year the more important element radium, using the residue of the pitchblende from Joachimsthal, placed at their disposal by the Austrian government. In 1903 they were awarded the Davy Medal of the Royal Society and the next year, jointly with Becquerel, were awarded the Nobel Prize in physics. Pierre Curie

was elected to the French Academy in 1905. He was run down and killed by a wagon in Paris, Apr. 9, 1906. See also **RADIUM**.

CURIEGRAM, or **CURIE**, the unit of **RADIOACTIVITY**, so named in honor of **MADAME MARIE CURIE**. A given sample of radioactive material is said to have a strength of so many curiegrams. As defined by the International Congress in 1910, it is the quantity of radium emanation, or radon, in equilibrium with one gram of radium. This occupies 0.61 cu. mm. under standard conditions of temperature and pressure and weighs 6.04×10^{-8} grams. It represents an exceedingly large amount of activity. J. B. H.

CURITYBA, capital of the state of Paraná, Brazil, situated about 65 mi. west of Paranaguá, its seaport. The city has a very healthful climate. Herva-Maté, or Brazilian tea, is the chief product of the near by district and the principal export of the city. Pop. 1920, 57,165; est. pop. 1930, 100,135, most of whom were German.

CURLEW, a genus (*Numenius*) of game birds allied to the sandpipers, found almost throughout the world. They are of large size, some exceeding 2 ft. in length, with long, slender, downwardly curved bills, long legs and spotted and mottled brownish plumage. Though usually frequenting the



OLD WORLD CURLEW
Numenius arquata

marshy shores of lakes and ponds, where they probe in the mud with their long bills for mollusks, crustaceans and worms, they are sometimes seen on dry plains and prairies far from water. In autumn when they feed largely upon berries, they were formerly highly prized for game. Curlews nest on the ground laying three or four spotted, olive-green eggs. When alarmed they rapidly take to wing, uttering shrill piercing cries.

The best known North American species are the long-billed curlew (*N. americanus*), and the northern curlew (*N. a. occidentalis*), both ranging through-

out the continent, the latter breeding only in the far North and wintering to the extremity of South America. Another species, the Eskimo curlew (*N. borealis*) is nearly or quite extinct and all three have become so scarce through over-shooting that they have been removed from the game list.

CURLING, a Scotch game played on the ice, with large smooth stones which the players slide toward a tee. The origin of curling is unknown; but the game has been a favorite winter sport in Scotland for more than three centuries. Curling is played on a rink 32 yards long and 10 yards wide, with a tee, or fixed mark, at both ends. The rounded stones weigh between 32 and 44 pounds, and are grasped by means of handles. There are generally four players on a slide. The aim of curling is to lay the stone as close as possible to the tee, to knock an opponent's stone from its scoring position, or to protect the well-placed stone of a partner from assault by the opposing players. Curling has a limited following in Minnesota, New Hampshire and Maine. In Canada the sport has many devotees.

CURLY MESQUITE, an important grazing grass of the Texas uplands. See GALLETA GRASS.

CURRAN, JOHN PHILPOT (1750-1817), Irish lawyer and orator, was born at Newmarket, Cork, July 24, 1750. In 1775 he became a member of Irish bar, and attracted such attention by his brilliant pleading that he soon became one of the leading lawyers in Ireland. He entered the Irish House of Commons in 1783 and his criticisms of the government imbroiled him in two duels. His legislative career was chiefly devoted to efforts against the Union. He died in London, Oct. 14, 1817.

CURRENT, a name applied to small seedless grapes (*Vitis*) dried as raisins, originally exported from Greece; also to various species of the *Ribes* of the saxifrage family. The latter are thornless shrubs which bear berries in clusters during summer. All are natives of the north temperate zone and because of their hardness they are especially valued in cold climates. The red currant (*R. sativum*), a native of the Old World, is the progenitor of several hundred varieties, a few of them white, used somewhat for dessert when fully ripe but mainly for jelly while still somewhat immature. The black currant (*R. nigrum*), also an Old World species, is popular in Europe and Canada but not in the United States for making jam and jelly. The red currants especially are the host plants for a fungous disease known as "white pine blister rust," which kills the native five-leaved pine. Hence it is unlawful in many parts of the United States to grow currants.

CURRECANTI NEEDLE, a massive pinnacle of rock located in the Black Canyon or Grand Gorge of the Gunnison River in southwestern Colorado. The rock is highly colored and rises hundreds of feet above the river. It culminates in a tapering spire from which it derives its name. The Denver and Rio Grande railroad and a U.S. Interstate Highway follow the Gunnison River at this point.

CURRENCY, MODERN. In the United States today currency consists of gold coin, silver, copper, nickel and bronze coin, specie certificates, government notes and bank notes. Gold currency has become relatively unimportant, being stored as bullion. Gold certificates are practically warehouse receipts for bullion. CHECKS, money orders, drafts and like instruments are not currency. COINS and currency are obtained from the Federal Reserve banks (see FEDERAL RESERVE SYSTEM) which took over the functions of the sub-treasuries on June 30, 1921 and now perform all sub-treasury functions including that of providing supplies of coin and currency to member banks. BANK NOTES are a form of credit currency (see CREDIT ECONOMY), being only partially secured by a gold reserve, the larger portion being secured only by the character and credit of the issuing government. Federal Reserve notes are a combination government note and bank note in that they are direct obligations of the United States but are actually issued by and are also obligations of the Federal Reserve banks.

Many theories involving numberless disputed points make a scientific definition of currency difficult. The intrinsic value of a ten-dollar bank note or an English one-pound note is merely that of the paper contained therein. The power of such money is contained in the obligations it imposes on the respective governments to make good its professed value. Economists are concerned with the question of how far currency should be restrained. If gold only were used and maintained at its real value the currency of a nation would keep its value the world over. But such a method would be too expensive to be practical. Methods have been evolved for using something besides precious metals. Silver and bank notes constitute such currency. Their value is maintained by the general confidence that the government will insure a continuance of its equivalence with real money.

Bank notes and bullion currency constitute what is known as a mixed currency. A currency which is not bullion and is not worth its nominal value in bullion is called a depreciated currency. A depreciated currency may be caused by a government calling notes or any other form of money a legal standard and issuing a greater quantity of them than the real transactions of the country and the property passing from hand to hand require. Any nation may create a currency, decree a nominal value and enforce its acceptance but its real value will be subject to laws outside of and stronger than any statute. No commodity has been found that combines the essential qualities of a standard of value with the physical properties requisite for a medium of exchange in small transactions, so metals of different values are used. To prevent the export or melting down of small change it is necessary to make it more valuable as coin than as bullion. But any wide discrepancy between the value of the standard money and other money in the form of coin is avoided as rendering the currency unstable. If the subsidiary coin is issued

in excess, it is liable to fall in value to the extent that it has been over-valued. In the absence of a special law requiring the acceptance of the less valuable money in payment of previously incurred debts, no one will be found willing to accept it at its face value as legal tender. If there is a law requiring the use of the cheaper money, the values of other commodities will become adjusted to the lower standard and the better money will disappear from circulation. *See also* GRESHAM'S LAW.

CURRENCY, PRIMITIVE. The establishment of a currency superseded the cumbrous system of **BARTER**. Within a narrow region, use of money verges on barter. African natives make purchases and pay debts with strings of beads and coils of brass wire. Travelers carry stocks of these just as in other countries they would carry **MONEY**. They are commodities used for ornament by the natives and yet they are distributed far beyond the demand as ornaments, and thus become currency. The first stamped money was made by the Lydians about 700 B.C. Coins were made of electrum, a metal consisting of three parts gold and one part silver. The weights of the coins conformed to the Babylonian silver standard. Phidon, king of Argos, is reputed to have established the first Greek mint in the island of Aegina, introducing the first engraved dies for this purpose about 600 B.C. The first American money was the wampum, and dried codfish of the Indians and was in regular circulation among the tribes of the eastern coast. A single fish was used as change in small transactions, being easy to transport and exchange with natives in the interior for something desired by the coastal Indians. Among the Indians of the Atlantic coast, however, a more developed form of currency was used, consisting of black and white shells strung like beads and varying in value. Not common enough to be easily found they represented labor; they also had a decorative value and were divisible by counting single strings or belts. Such wampum was one of the most complete currency measures known among primitive nations.

CURRENT, ELECTRIC. *See* **ELECTRICITY**.

CURRENT ASSETS, usually comprise **CASH**, temporary investments, **NOTES** and acceptances receivable, accounts receivable, inventories of stock in trade and supplies, accrued income (*see* **ACCRUAL**), and sometimes also regular prepaid operating expenses. Temporary investments arise out of seasonal cash surpluses which will be reconverted into cash at a later time. Such surpluses should be invested in securities subject to little fluctuation, as Federal, state, and municipal **BONDS**. The portion of the receivables to be included as current assets is that comprising claims against customers arising in regular course of trade. Inventories may include raw materials, goods in process of manufacture, finished parts, finished goods, and operating supplies of various kinds. Prepaid expenses include such items as unexpired insurance premiums, rent, interest and commissions, paid in advance. *See also* **ASSETS**. R. B. K.

CURRENT BALANCE, an instrument used in the absolute measurement of electric current. It consists, essentially, of a set of fixed and movable coils of wire, the latter attached, by a rod, to one arm of a finely constructed gravity **BALANCE**. In one form of current balance, three coils are used, one of which can move within the other two along a common axis. By means of the balance, the mechanical force exerted when an electric current flows through all the coils is measured, and from these measurements, together with the dimensions of the electrical system, the value of the current is calculated. The principal application of this instrument is in standardization and in investigations where the absolute accuracy of the results is of prime importance.

The *Kelvin Balance* is a portable type of current balance, but is a secondary instrument and, hence, requires calibration by means of another standard instrument. Its particular field of usefulness is in the calibration of alternating-current **AMMETERS**.

W. H. T.

CURRENT LIABILITIES, all debts falling due within a year for which payment must be provided. Debts to be refunded or cared for otherwise are not usually considered current, if suitable provision has been made for them. Current liabilities usually comprise **NOTES** and acceptances payable, accounts payable, accrued expenses; and—if the use of current assets will be necessary in particular instances to earn it—deferred income. All income received in advance of its being earned must be deferred to the period which earns it. The current creditors look to the current assets for satisfaction of their claim.

R. B. K.

CURRENTS, OCEAN AND SHORE, motions in the waters of the open oceans and seas. They may be divided into two kinds: the vertical currents due to differences of temperature, the colder water sinking down and the warmer and lighter water rising up; and the horizontal currents, caused by the prevailing winds. Practically the only source of information concerning the speed of ocean currents lies in the log-books of ships, where the speed of the ship with respect to the water is noted many times a day. The total daily run of a ship with reference to the water is calculated, and observation made of the ship's position at each noon, which supplies the distance actually run in 24 hours. The difference between the two gives a measure of the speed of the current.

The currents at the surface are subject to large variations in speed and direction as a result of local wind conditions. Owing to the sluggishness of water in adapting itself to conditions imposed upon it, layers a few fathoms down are little affected and give a truer indication of the average currents due to the prevailing winds. As a result of the **TRADE WINDS** blowing from an easterly direction there are westward currents in the oceans on either side of the equator, with an average speed of 15-20 miles per day with a compensating, eastward current flowing in between, influenced by the **MONSOONS**. In temperate latitudes

the westerly winds cause the water to flow in an easterly direction.

Where the westward equatorial currents meet the eastern coasts of the continents their waters are deflected away from the equator, and form the shore currents, often so narrow and sharply defined that they are called streams. In the Atlantic there result the GULFSTREAM in the north, and the Brazil current in the south. In the Pacific one finds the JAPAN CURRENT in the north and the Australia current in the south, while the Indian ocean has only the Moçambique current toward the south. The replenishing of water for the continuous upkeep of the circuit is accomplished by the inflow of cold waters from the pole, producing such currents as the Benguella current along the west coast of Africa and the Peruvian current on the west coast of South America.

Currents have a marked influence upon the climate of the continental coasts in temperate zones, because the prevailing westerly winds blow moisture-laden air from the warmer currents toward west coasts, making them warmer than the eastern coasts of the continents.

W. J. L.

CURRICULUM, a course or range of study pursued in an educational institution, as the college or high school curriculum. The curriculum of early elementary schools in the United States was planned with the idea that the students should all be developed along the same lines. The secondary school and college curriculums were designed for that relatively small number of students who would continue their studies beyond the elementary grades and who desired a classical education. As time went on the curriculums were changed slightly by adding new subjects, and in the case of the elementary schools by extending the number of years of attendance.

The whole trend of education has been changing since about 1900. It has been recognized that not only educational opportunities should be extended to all, but there are very definite differences in these individuals. It has been realized, too, that vocational training must be included in both college and high school. The changes in the curriculums to meet these new needs have, however, been spasmodic and until comparatively recently without on the whole any carefully organized effort. Curriculum revision is now being accepted as a major problem in education, and the NATIONAL EDUCATION ASSOCIATION of the United States, with other educational associations, is working out a nationwide program to stimulate co-operation among the school authorities in radical revision of their curriculums. It is now the custom in many cities to maintain a permanent committee composed of teachers to study and revise curriculums. Experimental schools of various types have been established to attempt to work out curriculums which would be better adapted to the various capabilities of individual students.

M. R.

See National Education Association of United States Department of Superintendence, *Yearbook*, 1926; United States Bureau of Education *Bulletin*, 1930, No. 16.

CURRIE, SIR ARTHUR WILLIAM (1875-), Canadian soldier and educator, was born in Napperton, Ont., Dec. 5, 1875, and educated at Strathroy collegiate institute. For five years he taught school in British Columbia and in 1900-14 was engaged in the insurance and real estate business. During the World War he commanded the 2nd Canadian Infantry Brigade (1914-15), the 1st Canadian Division in 1915-17 and was chief of the Canadian forces in 1917-19; and was decorated by England, France and Belgium for his services. In 1920 he became principal and vice chancellor of McGill University, Montreal.

CURTAIN, any textile material fixed to a rod or pole so as to form a screen for window or door. The use of a single curtain is very ancient and was due to the absence of glass and the ill-fitting windows. Bed curtains were an important household accessory until modern times. To-day there are two types of curtains in use at windows: the glass or casement curtains and the heavier draperies. Glass curtains act as a screen and soften but do not exclude the light, being of a sheer texture. Draperies provide a note of color and warmth and are important in any decorative scheme; in modern form they are usually lined, with a valance or top section. The ornamental cornices of the 18th century, now in vogue, are generally carved and gilded. See also PORTIERE.

CURTAIN THEATER, THE, a noted Elizabethan playhouse, probably the second to be built in England, erected by James Burbage in 1577, in Shoreditch, London. It is thought that SHAKESPEARE and his company acted at the Curtain between 1598 and 1599, between the time when THE THEATRE was being pulled down and THE GLOBE was being built. It is last mentioned in 1628.

CURTIS, CHARLES (1860-), American statesman, was born at North Topeka, Kan., Jan. 25, 1860. His grandmother was a full-blooded Indian of the Kaw tribe. After attending public school in Topeka, he read law, and was admitted to practice in 1881. In 1884 and 1886 he was elected attorney for Shawnee Co., and served in the House of Representatives from 1893 to 1907. The latter year he resigned, following his election to the Senate to complete the unexpired term of J. R. Burton. In the upper house he was president *pro tempore* from 1907 to 1911, and he was reelected to that body in 1914, 1920 and 1926. As the Senator from an agricultural state, Curtis vigorously supported all bills aimed to help the farmer, and originated several, the most important of these being the bill for the creation of the Farm Loan Board. He was nominated for the Vice-Presidency in the 1928 Republican convention at Kansas City, Mo., and his vigorous campaign speeches dealing chiefly with farm-relief proposals, helped to carry the Middle West for Herbert Hoover, with whom he was elected by a huge plurality in the electoral college. He was renominated for the Vice-Presidency in the 1932 Republican Convention, but was not elected.

CURTIS, CYRUS HERMAN KOTZSCHMAR (1850-), American publisher, was born in Portland,

Me., June 18, 1850. In 1876 he went to Philadelphia, becoming publisher of the *Tribune and Farmer*. In 1883 he founded the *Ladies' Home Journal* which he developed into its present leading position. As head of the Curtis publishing company he bought the *Saturday Evening Post* in 1897 and in 1911 he acquired the *Country Gentleman*. With John Gribbel he purchased the *Philadelphia Public Ledger* in 1913, and in 1923 took over the *New York Evening Post*.

CURTIS, GEORGE TICKNOR (1812-94), American lawyer, was born at Watertown, Mass., Nov. 28, 1812. After graduating in 1832 at Harvard he was admitted to the bar in 1836, subsequently appearing before the United States Supreme Court in many trials, including the *DRED SCOTT* and "legal tender" cases. He wrote a *Constitutional History of the United States*, 1889, a *Life of Daniel Webster*, 1870, *Life of James Buchanan*, 1883, and numerous legal works. He died in New York City, Mar. 28, 1894.

CURTIS, GEORGE WILLIAM (1824-92), American writer and orator, was born at Providence, R.I., Feb. 24, 1824. After attending local schools he spent two years at Brook Farm with his brother James, in close contact with leaders of transcendental thought. A four years' tour abroad resulted in the books, *Nile Notes of Howadyi*, *The Howadyi in Syria*, and *Lotus Eating*. *Potiphar Papers* appeared in 1853, and *Prue and I* in 1856. Before, during and after the Civil War, Curtis's orations, his editorship of *Harper's Weekly* and his leadership of reform movements made him a national influence. He died at New Brighton, N.Y., Aug. 31, 1892.

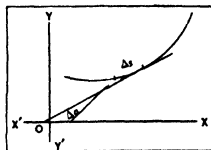
CURTIS, HEBER DOUST (1872-), American astronomer, was born at Muskegon, Mich., June 27, 1872. In 1897 he became professor of mathematics and astronomy at the University of the Pacific. He joined the staff of the Lick Observatory in 1902, becoming astronomer in 1909. In 1920 he became astronomer of the Allegheny Observatory, Pittsburgh, Pa. From 1900 to 1929 he was in charge of nine solar eclipse expeditions and in 1905 was director of the Lick Observation Station in Labrador.

CURTISS, GLENN HAMMOND (1878-), American airplane inventor and manufacturer, was born at Hammondsport, N.Y., May 21, 1878. He showed a bent for mechanics, and after designing several improvements in bicycle and motor-bicycle design, he succeeded in 1905 in launching the G. H. Curtiss Mfg. Co. In 1906 he won prominence by driving a motorcycle a mile in 26 2/5 seconds at Ormond Beach, Fla. Two years later he won the *Scientific American* trophy in an airplane competition, and in 1910 was awarded the \$10,000 New York World award for flying from Albany to New York in 2 hours, 51 minutes. His renown increased with the invention of the flying-boat. In recognition of his pioneer labors in the field of aeronautics Curtiss was presented in 1913 with a medal by the Smithsonian Institution. During the World War he manufactured planes for the Allied powers, developing the "Wasp"

and other types of fighting-planes. In conjunction with the Navy, he built the first plane to cross the Atlantic (May 16-27, 1919). His contributions to aviation have been generally ranked next in importance to those of Wilbur and Orville Wright.

CURVATURE, RADIUS OF, the radius of a circle which is determined by a curve at a given point as explained below. In the analysis of surfaces and plane curves two elements characteristic to those surfaces and curves are examined. These are the curvature and the radius of curvature. The curvature is defined as the limit of the average curvature $\left| \frac{\Delta \alpha}{\Delta s} \right|$,

where α is the angle formed by the tangent to the curve at a certain point and the line of reference; $\Delta \alpha$ is the angle between the tangents to the curve at two closely located points, and Δs is the length of the strip of that curve between those two points. When one of these two points



moves to coincidence with the other, the above expression approaches a limit $\left| \frac{d\alpha}{ds} \right|$, which is the curvature of the curve at that point. If the vertical lines denoting the absolute value are omitted, a rule of signs is usually given; i.e., it is generally agreed that if the curve is concave, the curvature is positive, and if convex it is negative.

The curvature of a curve at a point is the same of that of the tangent circle at that point, and the radius r of that circle is the radius of curvature, and defined as $\frac{1}{\kappa} = \left| \frac{ds}{d\alpha} \right|$. A straight line has a curvature zero and an infinite radius of curvature, the center of the circle of curvature being then said to be at infinity. See DIFFERENTIAL CALCULUS; DIFFERENTIAL GEOMETRY; INFINITY.

CURVATURE OF FIELD. See SPHERICAL ABERRATION.

CURVES, lines no part of which is straight. The term is used in mathematics in a more restricted sense than in everyday life. To have a geometric significance a curve must be defined either as a geometric locus (see GEOMETRY), or by means of its equation or equations (see ANALYTIC GEOMETRY).

If all points of a curve lie in the same plane, it is called a plane curve; otherwise, the curve is said to be twisted, or skew. If the equation of a plane curve may be put in the form of a rational integral polynomial (see POLYNOMIAL) in two variables equated to zero, the curve is said to be algebraic, for example, the Cissoïd or the CARDIOID. Otherwise the curve is said to be transcendental, as, for instance, the CYCLOID, or the sine curve. See TRIGONOMETRY.

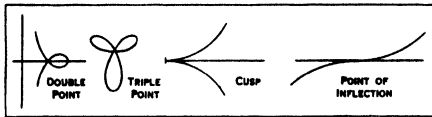
Plane algebraic curves are classified, according to the degree of their equation, into curves of the second degree, or CONICS; curves of the third degree, cubics;

of the fourth degree, quartics, etc. Thus the cissoid is a cubic, and the cardioid is a quartic. The degree of the plane curve indicates, geometrically speaking, the largest number of points which the curve may have in common with a straight line.

The degree of an algebraic skew curve is determined by the number of points the curve may have in common with a plane. A skew curve is thought of as the intersection of two SURFACES and is determined analytically by the equations of the two surfaces taken simultaneously.

The largest number of tangents which may be drawn from any point to a plane algebraic curve determines the class of the curve. Thus a circle, and a conic in general, is a curve of the second class. However, the class of a curve is generally different from the degree of the same curve. A cubic curve, for instance, is generally of the sixth class.

Plane curves of a degree higher than the second are often referred to as higher plane curves. A higher plane curve may have a double point, i.e., a point where the curve crosses itself. If the curve passes through the same point three, four, . . . times, the point is a triple, quadruple, . . . , and in general a multiple point on the curve. A multiple point is said to be a singular point on the curve. A higher plane curve may exhibit other singularities, such as cusps, points



SINGULARITIES OF HIGHER PLANE CURVES

of inflection, etc. The higher the degree of the curve the greater the variety and the complexity of the singular points it may have.

A curve is usually studied as a whole, mainly for its projective properties (see PROJECTIVE GEOMETRY), or for its differential properties in the neighborhood of one of its points. See DIFFERENTIAL GEOMETRY. N. A. C.

BIBLIOGRAPHY.—G. Salmon, *Higher Plane Curves*, 1852; A. B. Basset, *Cubic and Quartic Curves*, 1901; H. S. White, *Plane Curves of the Third Order*, 1925; S. Sanguli, *The Theory of Plane Curves*, 2 vols., 1925-6.

CURVILINEAR STYLE, the term applied to the second half of the Decorated period of English Gothic architecture distinguished by the use of flowing lines in window tracery. Historically this style followed the GEOMETRIC STYLE, and comprises, roughly, the first half of the 14th century. In its grace, richness, variety, lightness and imagination it shows English Gothic at what is generally considered its highest point of development. Windows are larger and window tracery is complex, varied and often naturalistic in form. Windows occupied more space. Vaulting was elaborated by the introduction of intermediate ribs. Spires were developed. Exeter cathedral is an excellent example, as a whole, of this style.

The vaulting of Exeter, the rose window of Lincoln, and the spire of Salisbury may be cited as illustrative details. See GOTHIC ARCHITECTURE.

CURZOLA, Serbo-Croatian Korcula, the ancient Corcyra Nigra, capital of the Yugoslav island of the same name off the Dalmatian coast, still has part of the old city walls and a tower of 1420. The Gothic cathedral was built during the Middle Ages. The Genoese took the Venetian Admiral Dandolo and the famous traveler MARCO POLO prisoner in 1298 during an encounter near Curzola. The island population in 1931 was 6,593.

CURZON, GEORGE NATHANIEL, 1st Marquis (1859-1925), British statesman, was born at Kedleston, Derbyshire, Jan. 11, 1859. He attended Eton and Oxford, and in 1886 was elected to Parliament. He was next appointed under secretary of state for India, then secretary of foreign affairs in 1895, and three years later viceroy of India. In 1905, during his second term of office, he resigned as a mark of his disapproval of the power accorded to Lord Kitchener, Commander-in-chief of the military forces in India. Returning to England, he took his seat in the House of Lords and from 1919-1924 was secretary of state for foreign affairs, in which office his imperious disposition more than once brought him into conflict with foreign statesmen. He is the author of several books as *Problems of the Far East*, *Russia in Central Asia*, *Persia and the Persian Question*. He died in London, Mar. 20, 1925.

CURZON LINE. Out of the post-war ruins of the Hohenzollern and Romanov empires there emerged, along with the several other new states, the republics of Poland and Lithuania, the former with its capital at Warsaw, the latter with its capital, at least for a brief period, at Vilna. The Paris peace conference did not definitely delimit the boundaries between the two republics, but Article 87 of the VERSAILLES TREATY provided that such Polish frontiers as were not specifically dealt with in the document itself were later to be determined by the Principal Allied and Associated Powers. On Dec. 8, 1919, accordingly, the Supreme Council established as the provisional Polish-Lithuanian boundary the so-called Curzon Line which assigned both the city and province of Vilna to Lithuania.

Both sides accepted the award, though in the case of Poland the assent was only provisional and was due largely to the circumstance that it was engaged in a war with Soviet Russia at the time. Before long, therefore, Poland and Lithuania were in open dispute over the region. Poland appealed to the League of Nations for settlement, and the League Council sent a military commission to the spot to end the fighting and restore order. On Oct. 7, 1920 the two states signed an armistice at Suwalki, provisionally accepting a revised Curzon Line which still left Vilna to Lithuania. Two days later an irregular Polish army under Gen. Zeligowski drove the Lithuanian officials out of Vilna and claimed the district for Poland. Public opinion in the latter country supported the general,

though Warsaw denied having had a hand in the escapade, and the League Council finally persuaded the rival claimants to agree to the holding of a plebiscite.

When for a variety of reasons a plebiscite appeared impractical, the Council attempted to get the matter settled by direct negotiations between the contestants. This alternative was no more successful than the previous ones, and on Feb. 3, 1923 the Council drew another provisional line this time giving Poland all the area that Zeligowski had occupied by force and thus disregarding the earlier Curzon disposition. Later the Council formally recognized this as the official boundary. Lithuania continued to protest the act of violence, and in the amended Lithuanian constitution of 1928, Vilna still was referred to as the country's capital. Passing years have served to increase rather than lessen the ill-will between Poles and Lithuanians.

W. C. L.

CUSHING, CALEB (1800-1879), American statesman, was born in Salisbury, Mass., Jan. 17, 1800. He practiced law at Newburyport, Mass., and served several terms in the state legislature before 1834, when he became a Whig member of Congress. During Tyler's administration he acted as United States commissioner to China, and in 1853-57 was United States attorney general. In 1860 he presided over the original Democratic convention and also over the seceders from the party. During the Civil War he was a loyal Union supporter. He acted as counsel for the United States in the arbitration of the Alabama Claims at Geneva, 1871-72. In the next year he was nominated by Grant for the position of Chief Justice, but the Senate refused to approve. In 1874-77 he was United States minister to Spain. He died in Newburyport, Jan. 2, 1879. He published several volumes of prose, among them *Life and Public Services of W. H. Harrison* and *The Treaty of Washington*.

CUSHING, FRANK HAMILTON (1857-1900), American ethnologist, was born in the village of Northeast, Pa., July 22, 1857. Interested in Indian relics, he made excavations at the sites of Indian camps. In 1875 he studied natural sciences at Cornell University and at the Centennial Exposition in Philadelphia was made curator of the ethnological exhibit. His outstanding achievements are the studies of ancient pueblo Indians and his explorations in the Salt River Valley, in Arizona, and New Mexico. Among his writings are *The Nation of the Willows*, *Zuñi Folk Tales*, and his *Report on the Ancient Key Dwellers of Florida*, which gives the result of the Pepper-Hearst expedition in 1896 which Cushing conducted. He died at New York Apr. 10, 1900.

CUSHING, HARVEY (1869-), American surgeon, was born in Cleveland, Ohio. He graduated from Yale in 1891 and took the degree of M.D. at Harvard in 1895. He was associate professor and professor of surgery at Johns Hopkins, 1902-11, and professor of surgery at Harvard University since 1912. He is surgeon-in-chief of Peter Bent Brigham Hospital, Boston. He is widely recognized as a leading

American surgeon in conditions affecting the nerves and the brain. He has published much fundamental medical research in these fields. His "Life of Sir William Osler," for which he received the Pulitzer prize of 1925, has been considered one of the greatest American biographies. He is also the author of several books of essays. Dr. Cushing was director of U.S.A. Base Hospital No. 5 in France in the World War and did much important work for which he was honored by the Allied nations. He has received many degrees from American colleges and honors from medical societies.

M. F.

CUSHING, HOWARD GARDINER (1869-1916), American painter, was born in New York City in 1869. He studied at the Julian Academy in Paris and under Laurens and Constant. He specialized in portraits and murals, painting a series of the latter in Mrs. H. P. Whitney's studio on Long Island. Cushing's portrait of Mrs. Ethel Cushing and his *Interior* are in the Metropolitan Museum, New York. He was an associate member of the National Academy. Cushing died in New York City, Apr. 26, 1916.

CUSHING, the largest city in Payne Co., north central Oklahoma, situated near the Cimarron River, 77 mi. northeast of Oklahoma City. Bus lines and two railroads afford transportation. There is an emergency landing field. The region has splendid oil and gas fields, as well as farm land producing cotton, grain and sorghum. Cushing is an industrial center, producing chiefly oil and cotton products. Near by is one of the largest oil tank-storage farms in the world, with a capacity in 1930 of 40,000,000 barrels. Cushing was founded in 1892 and chartered in 1894. Pop. 1920, 6,326; 1930, 9,301.

CUSHMAN, CHARLOTTE SAUNDERS (1816-1876), American tragedienne, was born at Boston, Mass., July 23, 1816, and began her career as a singer. Her first great success in drama was as Lady Macbeth, which she played at New Orleans, La., when only 20. She played leading rôles with W. C. MACREADY on his American tour, and was successful on her second London appearance in 1853. Charlotte Cushman's deep voice and gaunt features enabled her to play several masculine rôles; she appeared as Romeo to the Juliet of her sister Susan, and she also played Cardinal Wolsey. She was especially popular as Nancy Sykes in *Oliver Twist*; but her weird Meg Merillies, in *Guy Mannering*, was her most famous impersonation. She died at Boston, Feb. 18, 1876.

CUSK, or torsk (*Brosme brosme*), a fish belonging to the cod family is found in polar waters and on both coasts of the Atlantic as far south as Cape Cod and Norway. It has little value in American markets because of its coarse flesh and strong taste, but is sold to some extent in Scandinavian countries. The cusk is large, closely resembling the cod in appearance and habits, though it has but one dorsal fin. In 1929 the commercial catch of cusk in United States waters, taken almost entirely on the New England coast, amounted to 4,977,000 lbs. valued at \$122,000.

CUSTARD-APPLE, the common name for an important genus (*Annona*) of trees and shrubs of the custard-apple family. There are about 70 species, native chiefly to tropical America, several of which are cultivated for their luscious fruits. The common custard-apple or bullock's heart (*A. reticulata*), widely grown in tropical countries, is a small tree, sometimes 25 ft. high, bearing a somewhat heart-shaped fruit, about the size of an orange, with a yellow, tallow-like pulp. Other species valued for their fruits are the **SWEETSOP**, the **SOURSOP** and the **CHERIMOYA**.

CUSTER, GEORGE ARMSTRONG (1839-76), American soldier, was born in New Rumley, O., Dec. 5, 1839, and graduated in 1861 at West Point. He served on the staffs of Generals Kearny, McClellan and Pleasonton, the latter appointing him brigadier-general of volunteers. He fought with the cavalry at Gettysburg and later commanded brigades in the Wilderness and in the Shenandoah valley, where he commanded the last encounter before Appomattox. After the war he was commissioned lieutenant-colonel of the 7th U.S. cavalry and sent to Kansas to suppress the Cheyenne risings. From there he was ordered to Dakota and Montana against the Sioux. At Little Big Horn, Mont., Custer and his regiment were suddenly attacked by an overwhelming force of Indians and massacred, June 25, 1876.

CUSTER PARK, a state park in southwestern South Dakota, established in 1919 and increased to its present area of approximately 125,000 acres in 1921. It is considered one of the most beautiful state parks in the United States. It includes many majestic peaks of the Black Hills. Outstanding features are Harney Peak with an elevation of 7,254 ft., the Sylvan Lake region and the remarkable granite "needles." There are horseback and hiking trails and 100 mi. of motor highway within the park, as well as excellent fishing, boating and golf.

CUSTOMS, the institutions and behavior regarded as the norm in any society. Man, by trial and error, has developed certain ways of doing necessary things and these ways, initiated unconsciously by individuals, have become standardized for their groups. Thus, in the Aleutian Islands, fire is made by rubbing together two pieces of quartz, smeared with sulphur; in Tahiti it is made with a stick and groove; among the Eskimos with a bow drill; and among the Onondaga Indians with a pump drill. The dwellers in each of these regions regard their own way of making fire as the only feasible one.

Such standardization applies to the shape of house used in any community, to the style of clothing, the method of preparing food, the forms of magic and to the social institutions that develop, such as marriage, the initiation of adolescents, inheritance of property and religious rites.

Thus, in Australia, elaborate puberty ceremonies are held for boys; in California, they are for girls. Among the Pueblo Indians, inheritance is through the mother; among the Plains Indians, through the father. Among some Vancouver Indians, marriage is made official

only when the bride's father has paid a dowry to the groom. Among the Hidatsa Indians the groom pays a bride price for the bride. A love match without payment is looked down upon and women who have been paid for are accustomed to taunt women who have eloped for love as improper.

These folkways, originating in the convenience of individuals, are found convenient for other members of the group living under the same conditions. They may be practiced for a long time before they are recognized as the standard custom. The tendency then is for them to become more and more rigid until, in the course of time, they assume the force of law. Folkways which have reached this point of standardization have been called mores from the Latin *mores*, meaning custom.

It is the theory of Sumner and others that standardized mores ultimately acquire a religious sanction and are felt by those who practice them to be not only convenient but righteous, so that variation from them is a sin. It is quite usual for primitives to feel that they could not build their houses nor make fire any differently without fear of vengeance from the supernatural. The exponents of the theory of ethics as developing from mores consider that there is no norm of conduct imposed on man from without but that his standard of morality is merely the folkways of his group, crystallized into a system of ethics.

The permanence of ancient folkways supposedly submerged in modern institutions, is continually proved. Thus, until within a hundred years ago, the peasants of Europe used to ward off pestilence or diseases of cattle by the lighting of a bonfire which was evidently a relic of old magic fires of pre-Christian times. This fire must always be kindled by the rubbing of two pieces of wood, the primitive method by which fires were first lighted. If a modern match were used, the fire would not be holy.

Many of the modern forms of etiquette, divergence from which is regarded as a social misdemeanor are relics of earlier customs with quite different bearing. At present, a gentleman would be blamed if he did not take off his hat to a lady. In medieval times, knights took off their helmets on meeting one another as a proof that they trusted one another and were willing to leave their heads unprotected. R. M. U.

CUSTOMS DUTIES, taxes levied by a country on the importation and exportation of goods. They are among the oldest taxes known, being especially common during the Middle Ages and again during the regime of Mercantilism. The United States began to use import duties immediately after the formation of the Union but adopted a constitutional prohibition against export duties. A few nations still levy export duties although their use is much less than in the past. The world has experienced a general increase in the use of import duties since the World War as a result of the disturbances to trade following 1914. Even Great Britain, the traditional **FREE TRADE** country, has employed customs for **PROTECTION** as well as for revenue.

Customs duties are employed for various purposes. Fiscal duties are those designed to raise revenue for the government. These taxes do not play so important a part in the financial operations of governments as formerly. Growing needs have required the development of other sources of revenue. At one time customs revenues contributed over 90% of the total tax receipts of the United States Federal Government but since 1925 they have contributed only between 12 and 15%.

Protective duties are imposed for the purpose of restricting the movement of goods into or out of the country. This has come to be the major purpose of levying customs. Countervailing duties are levied on the importation of goods which have received a premium or bounty from the exporting country, they are designed to counteract the effect of the bounty. Compensatory duties are levied on imports of manufactured goods to offset duties imposed on raw materials. The compensatory duties protect the manufacturer from increased competition arising out of the burden placed on him by the duty on his raw materials. Anti-dumping duties are designed to neutralize the effect of DUMPING by imposing a burden sufficient to maintain the domestic price at its normal level.

In form there are three main types of customs duties: AD VALOREM duties, specific duties, and compound duties. Ad valorem duties are levied on goods as a certain percentage of their value. Specific duties are levied as a definite sum per physical unit of the commodity taxed. Thus the tax on imports of certain varieties of wool was placed at 24 cents per lb. Compound duties consist of both ad valorem and specific duties imposed at the same time. Certain types of woollen cloth, for instance, are taxed 50 cents per lb. plus 50% of their value. Ad valorem duties are elastic and automatically adjustable to changes in the value of the commodity taxed but they open the way to evasion through undervaluation. Because of this, specific duties have been supplanting the ad valorem form in recent years. Specific duties also possess additional advantages in ease of collection, low cost of administration and speed of computation.

Since 1922 the United States has been experimenting with flexible rates by giving the executive branch of the government the power to change rates within certain prescribed limits to meet fluctuating trade conditions.

The entire list of duties levied on imports is called a tariff. Not only does the ordinary tariff provide special rates for nearly every individual commodity, it may also carry more than one rate for the same commodity. This arises from the unwillingness of a nation to impose the same duties on commodities imported from all countries. Two of these dual tariff systems are in common use. The maximum and minimum system creates two distinct sets of rates, one considerably higher than the other. The maximum set is the normal one while the minimum rates are reserved for the products of those nations giving similar tariff concessions. In the general and conventional

system, only one set of rates is definitely enacted but lower rates may be granted by the negotiation of conventions, that is, commercial treaties, with each foreign nation. A modification of the general and conventional system is the preferential tariff which levies a still lower set of rates on imports from certain especially FAVORED NATIONS. Although the United States has experimented with both of the two main dual systems, it still has essentially a single schedule.

A. F. L.

BIBLIOGRAPHY.—U.S. Tariff Commission, *Dictionary of Tariff Information*, Government Printing Office, Washington, 1924.

CUSTOMS UNION, an alliance of two or more independent nations for the purpose of securing a more satisfactory tariff policy. A thoroughgoing union has two features. On the one hand, it provides for internal FREE TRADE by abolishing all CUSTOMS DUTIES between the members. On the other hand, it enables the participants to bargain more effectively with other nations by requiring all members to impose the same duties on imports from countries outside of the union. Less extreme alliances provide merely that goods passing between the nations concerned shall be admitted free of duty. Such is the union of Ecuador and Colombia.

The best example of a complete customs union is the German ZOLLVEREIN formed in 1834. Since the World War notable unions have been formed by Belgium and Luxemburg, the city of Danzig and Poland, Latvia and Estonia, and Switzerland and Liechtenstein. The proposed "Anschluss" between Germany and Austria was to be at its inception, essentially a customs union to be extended to other States that might desire to join, but as the International Court held that such a union would violate Austrian treaty obligations, the proposal was abandoned.

A. F. L.

BIBLIOGRAPHY.—G. M. Fisk and P. S. Peirce, *International Commercial Policies*, 1925.

CUSTOS ROTULORIUM, an office in England whose function is that of keeping the records of the sessions of the peace and of the commission of the peace. The office is usually held by the first officer or Lord Lieutenant of the county upon appointment by the crown.

CUSTOZZA, BATTLES OF. Custozza, a little village near Milan, was the scene of two battles in the struggle for Italian unification. The first took place on July 25, 1848 between the Austrians and Sardinians. The latter were severely beaten and retired, and Milan once again was taken over by the Austrians. The second occurred on June 24, 1866, also between the Austrians and Italians, in connection with the Austro-Prussian War in which Italy fought as an ally of Prussia. Here, too, the Austrians were victorious; but because of the decisive victories of the Prussians in Germany, Austria was obliged at the end of the war to surrender Venetia to Italy.

CUTHBERT, ST. (635-687), an English monk and bishop of the Holy Island of Lindisfarne, has

left no record of his birthplace and early life. He was prior of Melrose about 664 and later of Lindisfarne, off the coast of Northumberland. Of this latter diocese he was bishop in 685, adding the glory of his life to that of Oswald, who in 635 founded a monastery there whose ruins can be seen to-day. St. Cuthbert died on the island, Mar. 20, 687.

CUTICLE, CARE OF. See MANICURE PREPARATIONS.

CUTLERY, a term applied to table and pocket knives, and to various domestic instruments. Sheffield, Eng., has been one of the largest cutlery manufacturing centers for many years, while in the United States the New England states have many plants manufacturing a variety of cutlery.

The steel now used is generally melted in an electric or crucible furnace. The blade is forged at about 1600° F., trimmed, normalized, annealed, ground, hardened at approximately 1400° F. by quenching in water, reheated to straw tint to toughen, then polished and fitted with handles of wood, bone, pearl or ivory. Carbon content is from 1.00 to 1.20%. Stainless cutlery contains 0.30% carbon, 0.30% manganese and 12.00% chromium. See also CHROMIUM STEELS. C. M. J.

BIBLIOGRAPHY.—D. K. Bullens, *Steel and Its Treatment*; B. Stoughton, *Manufacture of Iron and Steel*.

CUTTACK, a city and district in Behar and Orissa, Bengal, British India, situated on the Mahanadi River and served by the Bengal-Nagpur Railway. Cuttack has been a British possession since 1803. The city is noted for its silver filigree work. The district of Cuttack comprises a hilly inland section, the delta of the Mahanadi and Brahmani rivers, and also include the River Baitarani. The rivers frequently overflow their banks and submerge the crops, which consist mainly of rice, the chief staple of the district, and jute. Area, 3,654 sq. mi. Pop. 1921, 51,007; district, 2,064,678.

CUTTEN, GEORGE BARTON (1874-), American educator, was born at Amherst, Nova Scotia, Apr. 11, 1874. He graduated from Acadia University in 1896 and took his Ph.D. at Yale in 1902. Ordained as a Baptist minister in 1897, he was pastor at various churches in Connecticut, New York and Ohio, until 1910, when he became president of Acadia University, Nova Scotia. In 1922 he became president of Colgate University.

CUTTERS, AGRICULTURAL, machines for cutting rough feeds into short lengths. Silage, or ensilage, cutters comprise a feeding mechanism, a cutter and an elevator. The feeder consists of an endless belt and rolls, which deliver the material to the cutter, the cutter being a set of rotating knives and a fixed knife. The elevating mechanism, which receives the material from the cutter, is usually a blower with a long pipe attachment reaching to the top of the silo; an endless belt carrier arrangement may be used. A recently developed silage cutter (see SILAGE CUTTERS) gathers standing corn and delivers the silage into a wagon.

Roughage Cutters, cut up filling feeds such as hay, cornstalks and straw, to produce roughage meal for live stock. The typical cutter comprises a cutting cylinder, which cuts the material into short lengths.

Root Cutters are used for slicing roots, as turnips, before feeding them to live stock. They usually comprise knives mounted on a rotating drum, a stationary knife and a feeding hopper.

CUTTING OF METAL. See METAL CUTTING BY HEAT; MACHINE TOOLS; GAS FLAME CUTTING; PARTING METALS; WELDING.

CUTTLEFISH, strictly, a cephalopod mollusk of the family *Sepiidae*. Many squids are inexactly called cuttlefish, and in the United States the name is applied to the octopods. There are about 100 species of cuttlefish inhabiting the shore waters of tropical and temperate seas. Only occasionally are they found in colder waters.

Cuttlefish are grotesque in appearance. They have oval or cylindrical bodies ranging in length from a few inches in small species, six to ten inches in the common European cuttlefish, *Sepia officinalis*, to a little over two feet in large ones. Ten arms, provided with suckers, surround the mouth, which two, longer than the rest, are specialized for seizing prey. They can be withdrawn into pouches. The cuttlefish are carnivorous, and live chiefly on crustacea. Their usual method of locomotion is by swimming with their fins, but if they need greater speed they can propel themselves backward by forcing water from their mantle cavities through their funnels. They are also capable of covering their retreat by expelling a cloud of "ink."

Cuttlefish are valuable to man in several ways. In some countries they are eaten; their ink produces the brown pigment, sepia; and cuttle bone, a calcified internal shell by which they can be distinguished from their cousins, the squids, is given to cage birds to be pecked at.

CUT-WORM, a term applied to the larvæ of any one of several species of moths of the family *Noctuidæ*. These caterpillars feed at night, cutting off the stems of young plants close to the ground. They climb young fruit trees and feed on the tender growths, if other food supplies are destroyed. They are most injurious to garden crops, rarely damaging grains or forage crops. During the day they hide under chips, stones or below ground. Adult moths feed at night or on cloudy days. In many species, eggs are deposited in lawns, meadows and weedy places. Young caterpillars hatch in the fall. They feed for a time on any available vegetation, most of them hibernating in the soil during the winter. Army worms are certain cut-worms which become so numerous as to destroy their food. They then march to seek other food. Poisoned baits are useful. As a means of cultural control, land should be kept free from crops and weeds during the late summer. J. R. T.

CUVIER, GEORGES LÉOPOLD CHRÉTIEN BARON (1769-1832), French scientist and naturalist, was born at Montbéliard, Aug. 23, 1769. He

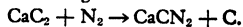
spent four years at the Stuttgart academy and in 1795 became assistant to the professor of anatomy in the Museum of Natural History. The following year he became a lecturer at the École Centrale du Pantheon, in 1799 professor of natural history in the Collège de France, and in 1802 professor at the Jardin des Plantes. Best known for his researches, he nevertheless gained prominence as an administrator. In 1808 Cuvier was appointed to the Council of the Imperial University and in 1819 became chancellor. He died in Paris, May 13, 1832.

As a scientist Cuvier gained notable distinction in three realms: paleontology, systematic zoology and comparative anatomy. His *Elementary Table of Natural History of Animals*, 1798, became the standard work on classification of species. *Leçons d'anatomie comparée*, 1800, laid the foundation for the science of comparative anatomy. Other important works are: *Recherches sur les ossements fossiles de quadrupèdes*, 1812, 1825; *Discours sur les révolutions de la surface du globe*, 1851; *Règne animal distribué d'après son organisation*, 1817, 1829-30, and *Mémoires sur les espèces d'éléphants vivants et fossiles*, 1800. Cuvier displayed a rare genius for putting together fossil remains but was conservative in their interpretation. An opponent of the evolutionary theory, he rejected the theory of descent.

CUYAHOGA FALLS, a suburban city of Summit Co., O., separated from Akron on the south by the Cuyahoga River. The city's transportation facilities include the Baltimore and Ohio and the Pennsylvania railroads. Its manufactures, valued at \$4,761,171 in 1929, include machinery, rubber products, paper, and building-material. The retail business in 1929 amounted to \$7,444,928. The extraordinary increase in population is due primarily to the city's residential attractions. Situated at an altitude of 1,100 ft., it overlooks the scenic Cuyahoga River gorge. The water power possibilities of the falls brought about the first settlement, known as Manchester, in 1812. Its facilities were tested by the milling of lumber for Com. Oliver H. Perry's warships in the War of 1812. The village, incorporated in 1868, became a city in 1921. Pop. 1920, 10,200; 1930, 19,797.

CUZCO, a city of Peru, the ancient capital of the Inca empire in the Andes 11,440 ft. above the sea. It occupies a defile in the valley of the Urubamba River at an elevation where the climate begins to be comfortable. This Spanish city, with three large plazas, is largely built on Inca foundations. The streets are so narrow, there is little wheeled traffic and there are many llamas and donkeys. Most of the inhabitants are Indians, and the Quechua language prevails. The native markets are a characteristic feature of the city. There are three woolen mills, and the manufacture of textiles is the most advanced industry. Above Cuzco stand the walls of the famous prehistoric fortress of Sacsahuaman. The city is the seat of a university and a bishopric. When Pizarro took Cuzco in 1533 there were 200,000 inhabitants. Est. pop., 1927, 61,000.

CYANAMIDE, a popular name for calcium cyanamide, a FERTILIZER material made by nitrifying calcium carbide according to formula



The process involves four steps: (1) calcining (See CALCINATION) of limestone in kilns; (2) fusion of the calcium oxide with carbon in electric furnaces to obtain CALCIUM CARBIDE, coke being generally used as the source of carbon in the process; (3) liquefaction and FRACTIONATION of air to obtain liquid nitrogen; (4) autoclaving the calcium carbide and the nitrogen to obtain calcium cyanamide. The commercial product is about half calcium cyanamide, the balance being calcium oxide, carbon and other impurities. Enough water is usually added to destroy any unconverted calcium carbide—often enough to slake the excess lime. The great drawback to the process is the large amount of power needed to make the calcium carbide. All four steps of the process have been practiced for some years and are well known.

The principal use of calcium cyanamide is as a fertilizer. It is also used as a raw material for calcium cyanide and urea manufacture. By autoclaving calcium cyanamide with water, and a little alkali, ammonia is liberated. See also NITROGEN FIXATION.

G. A. P.

BIBLIOGRAPHY.—E. Pranke, *Cyanamide Manufacture, Chemistry and Uses*, 1913.

CYANIC ACID, a strong colorless liquid acid (HCNO), extremely unstable and very volatile at ordinary temperatures. It quickly polymerizes to cyanamide. The vapor of the acid has a strong "blistering" effect. The salts of cyanic acid are called cyanates, potassium cyanate (KCNO) and ammonium cyanate (NH₄CNO) being the most important.

CYANIDE PROCESS, the most important process for treating gold and silver ORES. It is based on the fact that gold, and silver and silver compounds, are soluble in potassium or sodium cyanide solutions. The proper strength of solution varies from 0.1 to 0.01%. The ore is crushed, and the gold and silver leached out in tanks or filter presses. The gold is usually precipitated from the resulting solution by zinc. The precipitate is refined for the production of pure bullion. See also ORE TREATMENT.

CYANIDES, salts of prussic or HYDROCYANIC ACID. The cyanides of all the alkali metals, such as potassium cyanide, are white crystalline salts, extremely soluble in water. The cyanides of the alkaline earth metals, calcium, barium and strontium, closely resemble those of the alkali metals, but are more extensively hydrolyzed. The simple cyanides of the heavy metals, except mercuric cyanide, are insoluble in water. Sodium cyanide (NaCN) is used the most widely of all cyanides. It is used in extracting gold from its ores, in case-hardening steels, in electroplating, and as an insecticide. It is commonly prepared by the fusion of calcium cyanamide, common salt, and calcium carbide in an electric furnace. Potassium cyanide (KCN) is very poisonous. It is made by heating yellow prussiate of potash, and is used in extract-

ing gold and electroplating. Mercuric cyanide $\text{Hg}(\text{CN})_2$, also very poisonous, is made by heating potassium ferrocyanide with mercuric sulphate in water. It is sometimes used in the treatment of syphilis.

CYANIDING, a process for obtaining a very thin skin of extreme hardness on steel by carbon and nitrogen absorption and heat treatment. The process is suitable for parts not requiring high resistance to shock. The desired result is usually accomplished by first immersing the steel parts, clean and free from scale, for ten to fifteen minutes in a bath of cyanide salts made liquid by heating to $1400\text{--}1600^\circ\text{F}$. and then quenching in oil or water. The hard case is three to five thousandths of an inch deep. The cyanide compound used and its fumes are very poisonous.

CYANOGEN, a very poisonous, colorless gas (C_2N_2), obtained by heating mercuric cyanide. It is soluble in water and alcohol and burns in air. It is very stable when dry, but undergoes chemical changes in combination with water. It combines directly with hydrogen, the halogens, zinc, cadmium and iron.

CYBELE, the Asiatic name for the Greek RHEA and the Roman Ops, goddess of productivity. She was wife of CRONUS, and the mother of ZEUS, POSEIDON, HERA, DEMETER, HADES and HESTIA. Cybele was called mother of the gods, and was worshipped as mother of all nature. Her priests were the Corybantes. In Rome the Megalensian games were held in her honor. She is usually represented as drawn in a chariot by lions or seated on a throne with lions beside her.

CYCADOPHYTA, a plant group comprising about one-third of the fossil flora of the Mesozoic period. Under this head are included true cycads, akin to living forms, and a much larger group of extinct plants (Cycadeoids) to which transcendent interest has been given by the comparatively recent discovery that, earlier than any other known plants, they evolved a highly organized, if peculiar, bisexual flower. Impressions of cycad-like leaves and the grotesque silicified stumps, thickly armored with persistent leaf-bases, recognized at least as early as 1753, were long referred to as ancestral cycads. Since 1899 largely through the researches of Professor Wieland of Yale upon well-preserved material from the Black Hills of Wyoming and Dakota, it has been demonstrated that the majority of these fossils are not cycads at all, but adventurous flowering gymnosperms. The most interesting of the Cycadeoids, commonly spoken of as fossil cycads, are BENNETTITES and WILLIAMSONIA.

CYCADS, a family of tropical or subtropical plants, somewhat resembling tree ferns, but true GYMNO-

SPERMS. Dominant throughout the Triassic period, they have dwindled to 9 genera and about 75 species. The best known of these is the SAGO-PALM, the leaves of which are used as funeral decorations.

Cycads usually have stout woody trunks, half buried in the coontie, but tall and tree-like in *Cycas*, *Macrozamia*, and a few others. Their usually leathery, and often glistening leaves are always compound, with many leaflets, and often persist for years.

The flowers of cycads are dioecious, and, in all but one genus, are borne on the scales of cones, which attain considerable size in *Macrozamia* and some others. Being wholly without an ovary, petals or sepals, they are regarded as among the simplest of all seed plants. They are wind-pollinated.

The pith of some East Indian cycads, and of the tropical American coontie, yield a considerable amount of starch, widely used by the natives, but not the source of most commercial sago. They are often cultivated for ornament, especially *Cycas revoluta*, commonly called sago palm, although it is not a palm and yields but little sago. See COONTIE. N. T.

CYCLADES, a group of islands in the Aegean Sea southeast of Greece. NAXOS is the largest of these islands and others are ANDROS, PAROS, TENOS, MELOS, IOS, and MYCONOS. Some of the islands are volcanic in origin. Grape vines and tobacco are cultivated extensively. Among the exports are hides and marble. The Cyclades are to-day a part of the kingdom of Greece. Pop. 1928, 129,702.

CYCLAMEN, a genus of herbaceous plants of the primrose family comprising nearly 20 species found in Mediterranean countries and in central Europe, some of which have handsome foliage and showy flowers. The florists' cyclamen (*C. indicum*), which runs into many attractive forms, is highly prized as an ornamental. The solid, tuberous rootstock gives rise to broadly heart-shaped leaves and stout flower-stalks, 6 to 8 in. high, bearing white or rose blossoms with strongly reflexed and contorted corolla lobes.

CYCLE, one complete motion of anything performing the same motion periodically. It is commonly applied to the motion of ELECTRICITY constituting an ALTERNATING CURRENT, to a periodically changing potential difference or to the motion of the diaphragm of a MICROPHONE or LOUDSPEAKER.

CYCLING, the professional and amateur sport of riding a bicycle, and more strictly the name in the United States for competition among professional cyclists, dates from the organization of the National Bicycle Union of England in 1878. All the chief bicycle racing clubs of to-day are members of the Union Cycliste Internationale, whose rules govern the various branches of cycling. The racing bicycle is substantially similar in construction to the ordinary bicycle, although it may be geared to a higher ratio, and constructed of lighter tubing. Another slight differentiation is found in the handlebars, which in racing types are adjusted to a lower point than is conventional, so that the full weight of the rider falls upon



COURTESY M. OF FINE ARTS, BOSTON

CYBELE RIDING ON A LION
Terra cotta figurine from Asia Minor. Late 3rd century B.C.

the pedals. After the invention in 1899 of the safety bicycle, which succeeded the cumbersome high bicycle, the United States quickly took the lead in professional racing. The sport became profitable, and indoor and outdoor velodromes were constructed throughout the country. Public interest was aroused in 1899 when a cyclist named Murphy, with the aid of a windshield, covered one mile in under 60 seconds, on a special track constructed between the rails of the Long Island Railroad. The chief cycling events of the year in the United States are the amateur sprint competition, the professional sprint and paced meets, and the 6-day race. Riders in the latter event travel a circuit, appearing twice a year at Madison Square Garden, New York City; Detroit, Mich.; Chicago, Ill., and other cities. In 1910 the winning 6-day team was composed of Root and Moran (2545.3 miles); in 1920 the December championship was won by Brocco and Coburn (2289.9 miles), and in 1931 the winners of the March race were Letourner and Guimbretiere (2663.9 miles). Similar track racing events are held throughout Europe, where road racing is also popular. As an amateur sport and as a means of locomotion, cycling enjoys a greater popularity in Europe than in the United States, where moderate priced automobiles have supplanted bicycles to an appreciable degree.

CYCLOID, a curve first studied by Charles de Bouelles (1501) and later by Galileo (1599) and others. Its equation is

$$x = arc \cos [(a - y)/a] - \sqrt{2ay - y^2}.$$

It is the BRACHISTOCHROME CURVE. See also CURVES.

CYCLONE, a term originally used to describe tropical storms in which there was circular motion of air, as well as a "sucking" in toward the central region of low pressure, but now applied to all similar phenomena elsewhere, except to tornadoes, waterspouts, etc. where the principal motion of the air is in the vertical direction. The winds accompanying a cyclone would naturally blow toward the center, but according to BUYS BALLOT'S LAW are made to blow around it, counterclockwise in the northern and clockwise in the southern hemisphere. On weather charts they are often referred to as "lows" or "depressions," as against the "highs" of an ANTICYCLONE, or area of high pressure.

Cyclones usually move along with the prevailing winds, eastward in the temperate zone, westward in the tropics, sometimes they move with a speed of over 20 miles per hour and they are generally accompanied by a rise in temperature, heavy clouds and rain or snow, often by gales and severe storms. They form the most regular occurrence of "bad weather." See also STORM.

CYCLOPES, in Greek mythology, a powerful race or band of beings, variously described. Some said they were lawless Sicilian shepherds who ate men and were of gigantic size. Their leader was POLYPHEMUS who had only one eye, whence the idea of a one-eyed race. They were also said to be the sons of URANUS and GAIA or of Coelus and Terra. Hurled

into Tartarus by SATURN, they were rescued by ZEUS for whom they forged thunderbolts. APOLLO destroyed them because they forged the thunderbolt which killed AESCULAPIUS.

Another legend says that they were employed in the workshops of VULCAN, making armor for gods and heroes. Other writers spoke of them as mighty builders of walls.

CYGNUS (gen. *Cygni*), the swan, sometimes called the Northern Cross, a summer constellation that passes overhead about 9 P.M. during the middle of September. Its five principal stars form a cross, the long arm of which coincides almost with the Milky Way. Its brightest star, DENEK, which is of the first magnitude, forms a conspicuous triangle with VEGA and ALTAIR. Among the interesting objects may be mentioned the faint double star 61 Cygni, one of the nearest and fastest-moving stars known, which is 11 light years distant and has a speed of 64 miles per second. The constellation abounds in VARIABLE STARS. See STAR: map.

CYMBELINE, a legendary king of the Britons in the earlier part of the 1st century A.D., and the titular hero of a play by SHAKESPEARE. *Cymbeline*, derived in the historical parts from Holinshed's *Chronicle* and appearing about 1609, is the drama of Imogen, daughter of Cymbeline, and Posthumus Leonatus, her husband by a clandestine marriage. Posthumus, banished to Rome, one day makes a wager at the house of a certain Philario, that no man can tempt his wife, Imogen, from fidelity. The wager is eagerly accepted by the knavish Iachimo, who tricks the hero into believing Imogen untrue. Barely in time, however, the villainy is perceived, and Posthumus has his faith in Imogen restored.

CYNEWULF (9th century), Old English poet, known as the author of four poems to be found in the two MSS. entitled *The Exeter Book* and *The Vercelli Book*, both compiled in the 11th century. It is probable that these four poems were written about the year 800. They are written in the West Saxon dialect, with frequent interspersions of the Northumbrian, and are entitled "The Ascension," "St. Juliana," both in *The Exeter Book*, and "Elene" and "The Fates of the Apostles," the latter two being in *The Vercelli Book*. The poems are more notable for their scholarship than for any real poetic feeling. There is considerable speculation concerning the identity of Cynewulf. Some scholars are inclined to believe that he is the same person as Cynewulf, Bishop of Lindisfarne, who died in 783, though this opinion seems open to objection.

BIBLIOGRAPHY.—C. W. Kennedy, *Poems of Cynewulf Translated into English Prose*, 1910.

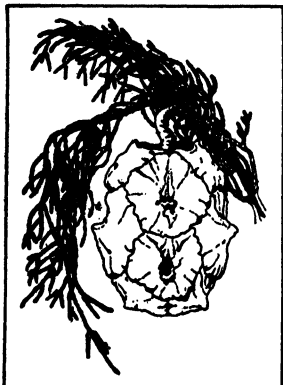
CYNICISM, One of the post-Socratic ethical schools emphasizing the importance of the virtuous life, virtue being considered the good in and of itself. The maxim of the school was "Virtue for virtue's sake." The good in virtue derived its meaning largely in opposition to pleasure, any form of pleasure being regarded as essentially an evil. Even the intellectual

and aesthetic pleasures were renounced by the Cynics. This led to a withdrawal from the world and a hostility toward all forms of social life. In their preference for nature to society they anticipated Rousseau. The leader of the Cynics was Antisthenes, and it is through his disciple DIOGENES that the term has come to be identified with an attitude of contempt for convention and a lack of faith in the worthiness of life. The Cynics were the forerunners of the Stoics, who refined their teachings. See STOIC.

CYNTHIA, in Greek mythology, the goddess of the moon and hunting. She was named after Mt. Cynthus on the Island of Delos where she was born. Cynthia is identified with the Greek ARTEMIS and the Roman DIANA.

CYPARISSUS, in classical mythology, the son of Telephus of Mysia. When by mistake Cyparissus killed his pet stag he was thrown into a state of such excessive grief that he was at last transformed into the most mournful of trees, a cypress.

CYPERUS, a large genus of flowering plants giving its name to the sedge family (*Cyperaceæ*). There are about 600 species, distributed widely over the warmer regions of the world, some 90 of which are found in the United States. They are somewhat grasslike or rushlike plants, distinguished chiefly by their triangular stems, leafy at the base, and two-ranked flowering spikelets borne in clusters or heads, subtended by a leaflike involucre. While not of high economic rank, the group contains many useful plants, as the papyrus (*C. Papyrus*), the umbrella-plant (*C. alternifolius*), and the chufa (*C. esculenta*), which are described in separate articles.



FROM JEPSON. MAN. FL. PLANTS CALIF.. COPYRIGHT

MONTEREY CYPRESS
Cone-bearing branchlet

CYPRESS, the English name of coniferous trees of the genera *Cupressus* and *Taxodium*. *Cupressus* has about 12 species, with durable resinous wood, minute scale-like leaves, and angular cone-scales meeting by their margins, natives of the southwestern states, Mex-

ico, Central America, southeastern Europe, and temperate Asia. *Cupressus sempervirens* has been cultivated in southern Europe since antiquity. *Cupressus funebris* is commonly planted in cemeteries and around temples in China and India. *Cupressus obtusa* is a valuable timber tree of Japan. *Cupressus macrocarpa*, the Monterey cypress, is the most extensively planted ornamental conifer of the Pacific states, growing rapidly, enduring a variety of climates, and adapted to severe pruning so that it may be grown as a hedge or trimmed into ornamental shapes. It is also extensively cultivated in the warmer parts of Europe, temperate South America, and Australia. As a wild tree it is restricted to a narrow strip of land about 2 mi. long on the coast of the Pacific near Monterey, California.

The genus *Taxodium* includes three species of North America, commonly known as Bald Cypress. *Taxodium distichum* and *T. ascendens* inhabit wet lands and swamps in the southern states. They are large trees, reaching a height of 150 ft., with small, narrow, deciduous leaves and trunks conspicuously swollen toward the base. From the spreading roots vertical woody growths called cypress knees (not always produced) rise above the surrounding water and serve as aeration organs for the submerged parts. Cypress lumber is highly valued for its durability, especially in contact with moisture. *Taxodium mucronulatum* of southern Mexico is also a large tree. The famous specimen at Tule, Oaxaca, exceeds 100 ft. in girth and 150 ft. in height and is doubtless more than 2,000 years old. H. A. G.

In 1930 the total cut of cypress lumber in the United States amounted to 490,857,000 bd. ft., valued at the mill at \$16,247,367. To this output, which was produced entirely in the southern states, Florida contributed 40.5% and Louisiana 22%.

CYPRIAN, ST. (c. 200-258), bishop and martyr, was born Thasius Caecilius at Cyprus about 200. Of his birth and early life little is known, but he appears to have been a wealthy citizen of Carthage in 246 when, under the influence of an aged priest, Caecilianus, he became a Christian, selling his property and gardens for the church. His friends bought the property and restored it again to him, thus enabling him to help the victims of the Decian persecution which began in 250. His writings include *Ad Donatum* and *Testimonia ad Quirinum*. In 257 he was exiled to Curubis by the proconsul Paternus, and was beheaded at Carthage, Sept. 14, 258. His life was written by his deacon, St. Pontius.

CYPRIPEDIUM, a genus of hardy orchids known commonly as lady's-slipper and moccasin-flower, because of the curious shape of the flowers. There are about 30 species, all terrestrial plants, found chiefly in swamps and damp soils in temperate regions, some 10 of which occur in the United States. They are unusually attractive plants, with broad, many nerved leaves and showy, drooping flowers. The green-house plants called cypripedium are mostly species of *CORIDULA*.

CYPRUS, an island of the eastern Mediterranean, after Sicily and Sardinia the largest of all Mediterranean islands. It lies 40 mi. from the coast of Asia Minor and covers an area of 3,584 sq. mi., being 140 mi. long and averaging in width from 35 to 50 mi. It is traversed by two ranges of mountains between which stretches an extensive plain known as Mesaoria. The highest point of land is Mt. Troodos, rising 6,406 ft. above sea level. The main streams are Yalías and Pedias. The soil of Cyprus is famed for its fertility and agriculture is the chief occupation of the inhabitants. Vineyards cover a large part of the cultivated area. Wheat, barley, cotton, oats, potatoes, flax and hemp are extensively cultivated. Various fruits, especially olives, carobs and mulberries, are grown. The chief exports are domestic animals, olive oil, cereals, fruits, wines, cotton, silk, dairy produce, asbestos and copper ore. Sponge-fishing and the manufacture of cigarettes and embroideries are important industries.

Cyprus has been a British possession since 1914, when it was taken from Turkey. In 1925 it was created a colony. The governor is assisted by an executive council and a local legislature. The capital of the island is Nicosia, pop. 1931, 23,507. Other principal towns are Limasol and Larnaca. Pop. 1931, 347,959, most of whom were Greeks.

CYRANO DE BERGERAC, a French poet and adventurer (1620-55), and the hero of a romantic play of that name by EDMOND ROSTAND. In the play (produced 1897) Cyrano is a noble-hearted tragi-comic figure who, with his ready wit, helps young Christian de Neuvillette to win Roxanne, though he is madly in love with her himself. Soon after their marriage, Christian is killed in battle, and the inconsolable Roxanne retires to a convent. Years later, when at the point of death, Cyrano confesses to the unsuspecting Roxanne that he has loved her all his life.

CYRENAICA, an ancient territorial division on the north coast of Africa. It was at one time an important trading center, but lost much of its revenue when the Egyptians extended their sway over the section. In the 1st century B.C. Cyrenaica came under the rule of the Romans. To-day the district is inhabited chiefly by Arabs who raise grain and cattle.

CYRENAICS, a post-Socratic ethical school holding that pleasure is the only good. The Cyrenaics were the early hedonists, the forerunners of the Epicureans. (See EPICUREANISM.) The leader of the school was Aristippus, who in his earlier days had been a Sophist. Although Aristippus himself recognized the superiority of the more lasting pleasures, such as the intellectual and the social, this point of view was not characteristic of the school. The most intense pleasures were regarded as the best by some of its members, momentary excitement being held superior to the more enduring pleasures. Paradoxically, this doctrine reached its culmination with Hegesias, who advocated suicide. The aim of life, he held, is pleasure, and since experience shows that existence affords more pain than pleasure, the only way to get

the most pleasure from life is to escape it by death. Starting with opposite premises, the Cyrenaics thus arrived at, and even went beyond, the conclusions of the Cynics. See CYNICISM.

CYRENE, an ancient city of Africa, located a few miles from the Mediterranean Sea. Founded in the 7th century B.C. by Greek colonists, it later passed under Egyptian and then Roman rule. Cyrene was a well-known cultural center in ancient times and numbered among its illustrious men CALLIMACHUS and ARISTIPPUS. Ruins of the old town may be seen to-day.

CYRUS, name of two important members of the Achaemenid family ruling in ancient Persia. I. Cyrus the Great, founded the Persian empire (c. 558 B.C.) by a successful revolt from Media. Attacked by Croesus, king of Lydia, who depended upon the support of Babylonia, Egypt and Sparta, he defeated him, capturing Sardis in 546 B.C. Thereupon he converted Lydia into a Persian province. Leaving the subjugation of the whole of Asia Minor to his general Harpagus, Cyrus proceeded to the reduction of Babylonia. After a long siege, ingeniously conducted, Cyrus took Babylon, 539 B.C., at the same time gaining control of the Babylonian provinces in Syria. Ten years later, in 529 B.C., engaged in the conquest of the Massagetae, a people dwelling to the southeast of the Caspian Sea, he lost his life. Revered by the Persians as a father, he was respected by the Greeks alike for his ability and his humanity. Xenophon in his *Cyropaedia* has drawn an idealized portrait of him as a monarch virtuous, courageous, and wise. II. Cyrus the Younger, son of DARIUS II, inordinately ambitious, tried to wrest the kingship of Persia from his older brother Artaxerxes, the rightful heir to Darius. From Sardis, the seat of his government as satrap of Lydia, Phrygia and Cappadocia, Cyrus led forth an army including some thirteen thousand Greek mercenaries, ostensibly to stamp out banditry in Pisidia. But marching his army into the heart of the Persian empire, he met his brother at Cunaxa, not far from Babylon. In the ensuing battle Cyrus was killed, 401 B.C. The story of Cyrus and the retreat of the Greek mercenaries amid terrible hardships to the sea is graphically told by Xenophon, their leader.

G. M. H.

CYST, an abnormal cavity within the body, containing fluid or semi-solid substance. Some types of cysts arise from the continued growth of tissue displaced during embryonic life. These are termed dermoids and are usually found just under the skin. Certain hollow structures, especially in connection with the ducts of the ovary or testis, which normally degenerate, may enlarge. Other cysts arise late in life as a result of the distension of cavities which have no means of drainage, or from the blockage of ducts of glands. Certain parasites, as the pork round worm or the dog tapeworm, produce cysts as a result of their growth. The former produces small hard cysts in the muscles, while the latter causes large fluid-containing cysts in the liver. The degeneration of

tumors poorly supplied with blood form another type of cyst.

The usual treatment of cysts is excision by a surgeon.

CYSTOSCOPY. See UROLOGY: Diagnosis.

CYTHERA, the ancient name of the island of Cerigo, the most southerly of the Ionian Islands off the extreme southern end of Greece. Phoenicians were said to have colonized it. Sparta gained possession of Cythera to lose it to Athens during the Peloponnesian War, but regained it in 421 B.C. Off its shores VENUS is supposed to have sprung from the sea and a temple was built to her near the spot. The island was famous for its fisheries. The chief exports are sheep, goats, wheat, olives and cotton. The capital is Paleokastro.

CYTHEREA, in Greek mythology, a surname of APHRODITE, so-called from the island of Cythera, which was both her birthplace and an important center of worship.

CYTOLOGY, a division of biology devoted to the study of the CELL. Since the living substance, or protoplasm, of animals and plants exists in the form of cells or their equivalent, and since the cells of the mature body are derived by cell division from pre-existing cells and hence ultimately from the fertilized egg cell or zygote, and since furthermore the vital activities in last analysis express cell activity, cytology bears an important relation to other divisions of biology, such as histology, embryology and physiology. Cytology is contributing much toward an understanding of the material basis of heredity and promises marked aid to genetics. Cytology also has close relations with general biology and shares many problems such as sex, reproduction and the like.

As a distinct field of study and research cytology has mainly developed during the 20th century although the discovery of the fundamental facts of cell structure, function and origin belongs earlier. See also ANATOMY.

B. F. K.

CZECH LITERATURE. Literature began in Bohemia soon after the introduction of Christianity in the 9th century, but became important only in the 13th century. The early saints' legends and religious songs and dramas are similar to those in western countries. In secular literature the most significant documents are a rimed chronicle and a long poem on the legendary history of Alexander the Great; there are also satiric poems. National heroic poetry did not exist; poems of this sort "discovered" in the 19th century have been proved forgeries.

In the 14th century a religious movement began, one of the leaders in which was Stitný (c.1331-c.1401), the first writer of Bohemian philosophic prose. His greater successor was Jan Hus (c.1369-1415), the founder of a reform movement against the church authorities. Though his masterpiece, *On the Church*, is in Latin, his Bohemian works are also noteworthy. After the burning of Hus as a heretic came a period of religious wars and of prose literature, largely of religious controversy. Humanism spread in Bohemia,

but produced only a literature of learning, not of the imagination.

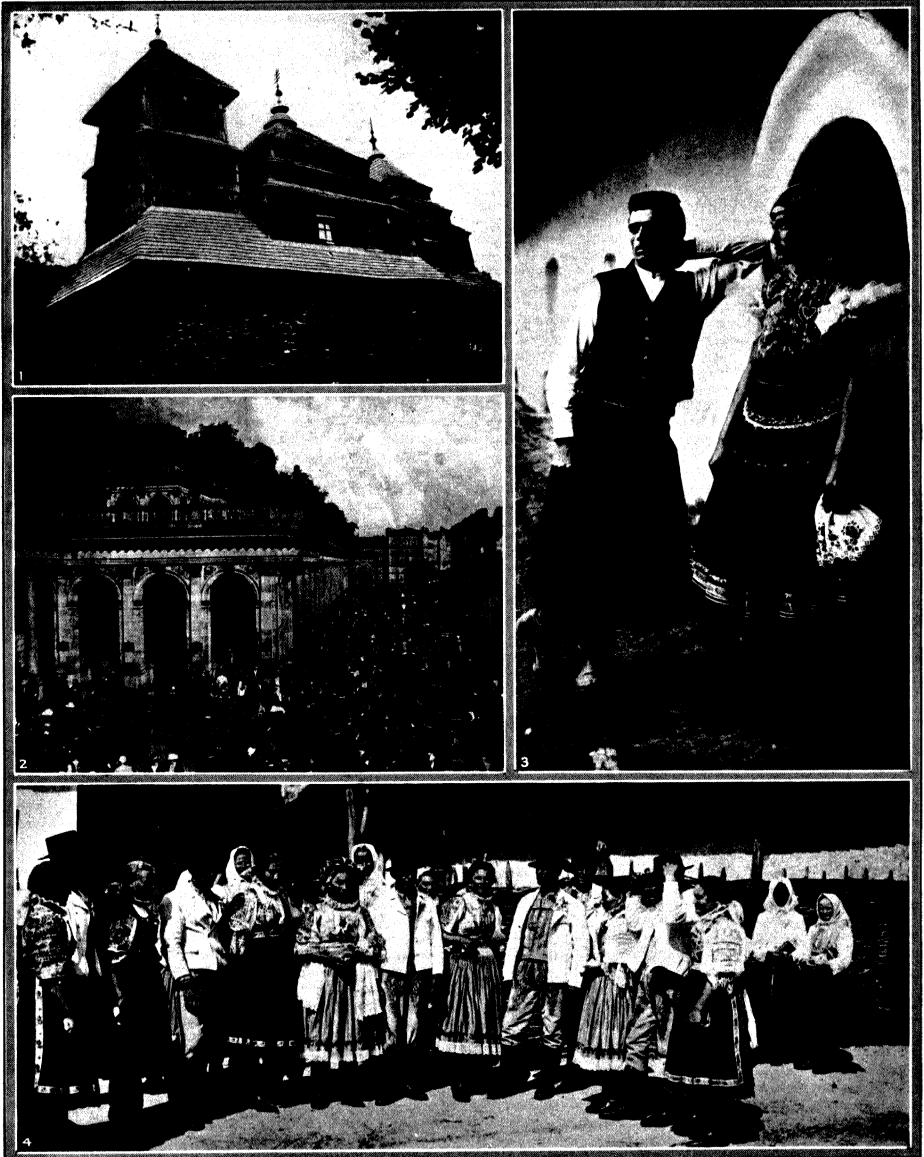
The greatest author of the 15th century is Chelický (c.1390-c.1460), whose *Net of Faith* is a burning attack on the Roman Church and on the state authorities, a plea for a life of non-resistance and of poverty. Chelický was the spiritual father of the sect of the Bohemian Brethren, the main religious and intellectual force in the country. Komenský (Comenius; 1592-1670), the last bishop of the Brethren, wrote in Bohemian his *Labyrinth of the World*, one of the greatest of religious allegories; later, as an exile writing in Latin, he became a leader among reformers of education.

After the extinction of Bohemian independence in 1620 the Bohemian nobility was exterminated or germanized; Bohemian became a mere peasant tongue, not used in literature. The "Bohemian renaissance" began at the end of the 18th century through the work of scholars, the first of whom was Dobrovský (1753-1829), the founder of Slavic philology; and under the influence of the romantic movement, with its emphasis on national and popular elements in literature (see also ROMANTICISM). The historian Palacký (1798-1876), with his exaltation of the past greatness of Bohemia, was the intellectual leader of his nation. The artistic merits of the pioneers in belles lettres are small; they were men educated in German, who used Bohemian only from a sense of patriotic duty. Kollar (1793-1852), a Slovak, whose *Daughter of Sláva* is a series of sentimentally patriotic sonnets, and *Mácha* (1810-36), a disciple of Byron, are the first real poets. Božena Němcová (1820-62), the first important writer of fiction, devoted herself to the humbler folk; her village idyl, *The Grandmother*, has enduring charm.

In the second half of the century Bohemian authors were numerous; but none acquired really international fame, and even at home the reputation of most of them has declined. Poetic style came to its maturity in the copious work of Čech (1846-1908), Vrchlický (1853-1912), and Zeyer (1841-1901), all of whom also used prose. Čech, the last author of the Bohemian renaissance, wrote in a strongly nationalistic vein; his *Blacksmith of Lešetín* was long the most popular of Bohemian poems. The romanticism of Vrchlický and Zeyer is of a more cosmopolitan and eclectic sort. Village romanticism was the characteristic note of the novelist Karolina Světlá (1830-99). Of several historical novelists by far the most important is Jirásek (1851-1930) who, in a long series of novels and dramas, treats of the national struggle for independence and of the Bohemian renaissance; he is the most popular of Bohemian authors; his work may be compared to that of Scott and of Sienkiewicz.

The following generation of writers broke away from the Romantic and sentimental tradition. Masaryk (1850-), a sociologist and a positivist philosopher, was the greatest intellectual force in Bohemia in the years preceding the World War; in 1918 he became the first President of the Czechoslovak Republic.

CZECHOSLOVAKIA



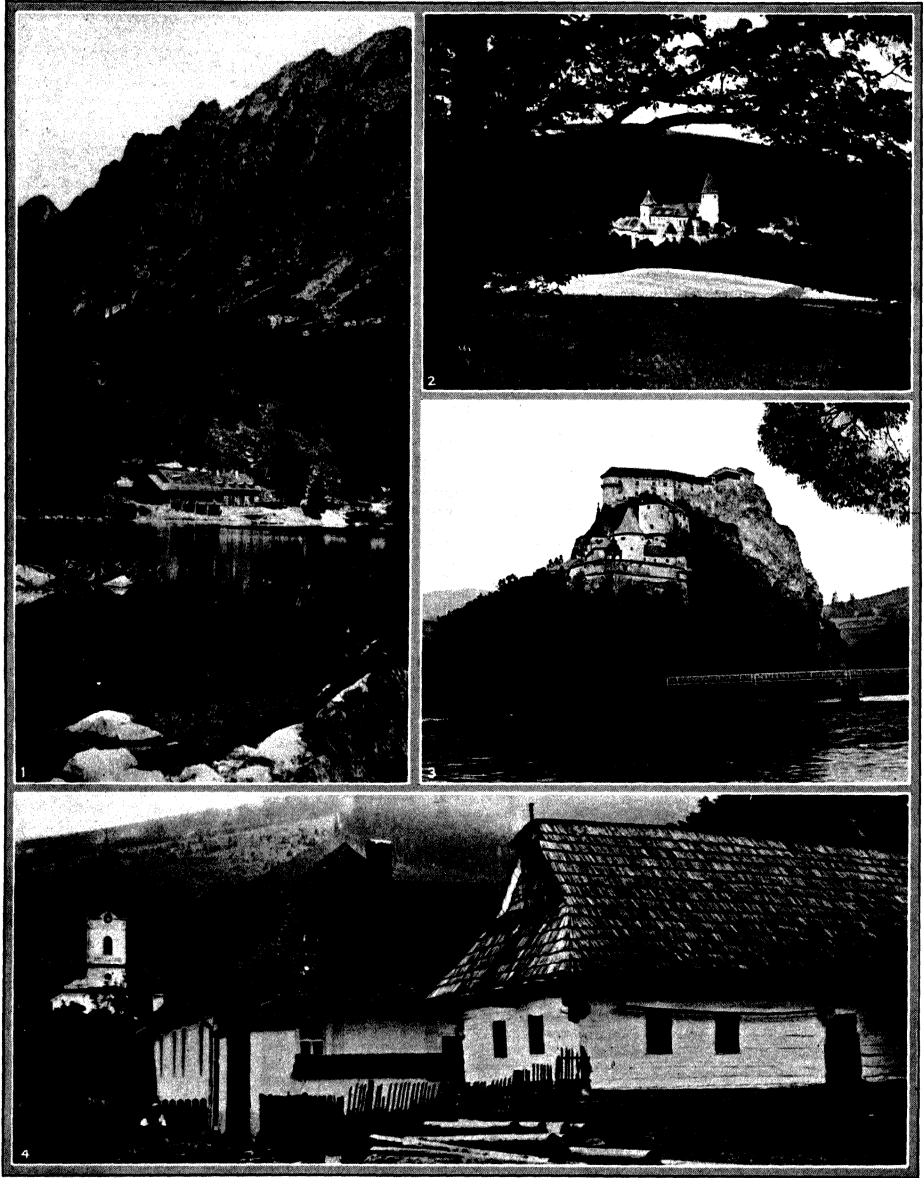
COURTESY CZECHOSLOVAKIAN CONSULATE-GENERAL

CZECHOSLOVAKIA AND ITS PEOPLE

1. A wooden church at Kostrim, in the Carpathians. 2. Carlsbad, a popular Czech spa in Bohemia. In June and July the town is crowded with visitors. 3. Costumes

of a Czechoslovakian peasant couple. 4. The picturesque peasants of Slovakia wearing their national dress, which is donned on holiday occasions.

CZECHOSLOVAKIA



1. 2. COURTESY CZECHOSLOVAKIAN CONSULATE-GENERAL; 3. CENTRAL EUROPEAN PRESS; 4. PHOTO-POSSELT-SMICHOV

TYPICAL PROVINCIAL SCENES IN CZECHOSLOVAKIA

1. Lake Poprád, eastern Czechoslovakia, with the High Tatra in the background. 2. The medieval castle of Křivoklat, Bohemia. 3. The castle of Orava, northern Czechoslovakia. 4. Dwellings in Telgart, Ruthenia.

lic. The novelists turned from sentimentalism and nationalism to realism. Chief among them is perhaps Čapek-Chod (1860-1927), whose *Rešany* has been termed the finest of Bohemian novels. Machar (1864-) gave a realistic turn even to poetry; his *Magdalen* is a satire on social hypocrisy. In contrast, Sova (1864-1928) and Březina (1868-1929) are lyric poets whose work is pervaded by philosophy or by a mystic symbolism. The dramatist Karel Čapek (1890-) has become better known outside his own country than any other modern writer. His masterpiece *R.U.R.* or *Rossum's Universal Robots*, is a pseudo-scientific melodrama that has given a new word to the English language.

G. R. N.

BIBLIOGRAPHY—Lutzow, *A History of Bohemian Literature*, 1920; F. Chudoba, *A Short Survey of Czech Literature*, 1924.

CZECHOSLOVAKIA, an inland republic of central Europe, bounded on the north by Germany and Poland, on the south by Austria, Hungary and Rumania. Area 54,207 sq. mi.

The republic was proclaimed on Oct. 28, 1918 and finally confirmed two years later by the major powers. It comprises the old kingdom of Bohemia (BOHEMIA, MORAVIA and part of SILESIA), the Slovak territory of former Hungary, and the autonomous territory of SUBCARPATHIAN RUTHENIA. On the map of Europe the country is conspicuous because of its peculiarly elongated shape and central position. It lies about equidistant from the Baltic and Adriatic, the North and Black seas. From east to west it stretches about 600 mi., while its north-south width varies from 60 to 125 mi.

Physical Features. The broad western part of the country has as its dominant physical feature the old Bohemian mountains. The narrower eastern portion includes the southern slopes of the Carpathians. Separating the two is a depression draining into the eastward flowing Danube and the Odra (Oder) flowing north. Bohemia is a plateau almost completely rimmed by forest-clad mountains. On the southwest is the Bohmerwald, the largest timbered section; on the northwest, the Erzgebirge, long famous for their minerals; on the northeast, the Sudetes; and to the southeast the Moravian Heights. The plateau is tilted northward and its drainage, gathered by the Labe (Elbe) and its tributaries, escapes via the Labe Gate between the Erzgebirge and Sudetes, across the German plain to the North Sea. Bohemia's underlying strata is old crystalline rock, except the central and north-eastern sections where there are glacial sedimentaries. The valleys of the lower Vltava (Moldau) the Labe and the Ohře (Eger) lie in this limestone and are covered with alluvium providing the most fertile portion of the plateau. The eastern part of this massive plateau is drained southeastward by the Morava and its tributaries to the Danube.

The narrow gap between the Sudetes and the Carpathians through which the Odra flows is known as the Moravian Gate, one of the most important passes of Europe. Not only is there a break in the mountain

wall, but three important rivers rise close to the opening; the Odra, whose channel lies in the gap, leads to the Baltic Sea; the Vistla (Vistula) leads northeast to the Baltic; and at the south entrance of the gateway is the upper Morava, leading to the Danube. In the east SLOVAKIA and Ruthenia much more mountainous, occupy the southern slope of the Carpathians and include the margin of the great Hungarian plain. The drainage is to the Danube which for about 100 mi. forms the frontier. In Slovakia the south-flowing rivers have cut the country into a series of parallel ridges with more or less isolated valleys. In Ruthenia there is an extension of the Hungarian plain.

Climate. The climate is similar to the remainder of the continent in type, with cold winters. The Labe is closed by ice for about 11 weeks each year and the snow of the Carpathians is regularly used in logging operations. The rainfall is moderate in the mountains: 30 to 35 in. but rather light, 15 to 20 in. on the plains. Fortunately about two-thirds of the precipitation occurs in the summer when most needed; moreover, because of latitude, that season is not very hot.

Minerals. The bituminous coal and lignite resources are of fundamental importance to the country's economic progress. The coal of the Ostrava-Karvinna district is of coking grade and for that reason is in great demand both for domestic use and for the adjacent industrial districts of Poland and Germany, more particularly since the other Upper Silesian deposits are not suitable for this purpose. About one-half of the product is exported. Supplementing the bituminous coal production is lignite, chiefly from the northwestern frontier of Bohemia, the annual output being about 50% greater in tonnage than is that of bituminous coal. Silver is extracted at Příbram and Jáchymov (Joachimsthal), radium near Jáchymov, and graphite at České Budějovice, and there are also crystalline clay and quartz in the sandstone areas, on which the china and glass industries operate.

Forests. One-third of the country is forested, mostly by conifers, and timber constitutes an important part of the national wealth. Much of that privately owned prior to 1918 was in large estates whose expropriation is expected to increase the state-owned areas. In addition to the supply supporting extensive wood-consuming industries, there is a large export of timber and wood products. Although the east has the greater proportion of tree coverage, the bulk of the wood manufactures is from the industrial west. Almost one-half of the wood cut is for fuel.

Agriculture. As a whole, the country is almost self-sufficient in foodstuffs, a condition which facilitates its economic stability. In spite of rough surface features the arable proportion is high, reaching 42%; the part unproductive is extremely small, while forests and pasture occupy about one-half of the total surface. Czechoslovakia lies in the great temperate belt so favorable to grain and root crops which extends across north and central Europe. Sixty per cent of the arable land is in grain, and the predominance of rye,

oats and barley is indicative of the large areas of poor or only moderately fertile soil, especially in Slovakia and Ruthenia, with wheat and sugar beets monopolizing the richer land, corn being restricted to southern Slovakia. The best agricultural region is in northern Bohemia, in the lower valleys of the Vltava, Labe and Ohře, where, as in southern Slovakia, there has been a rapid increase in sugarbeet production. The republic has in certain years ranked first among exporters of beet sugar and is surpassed only by Germany in production. About 70% of the output is for export, amounting in recent years to over 1,000,000 tons annually. The relative importance of agriculture, the special phase which is emphasized, and the methods used in western Czechoslovakia are in marked contrast with those of the east. In the latter (Slovakia and Ruthenia) over two-thirds of the population are peasant farmers using primitive methods; in the west, over one-half of the people live by industry and commerce. Here, too, agriculture is more intensive and methods are scientific and modern, while in the east greater emphasis is laid on the pastoral phase, and activity is governed by tradition and chance. General illiteracy and backwardness characteristic of the populations formerly dominated by the Magyars is reflected in their agricultural practice.

Until 1920, land tenure smacked strongly of feudalism. In no other country of central Europe were there such an unequal distribution of land ownership. At one time it is said that one-sixth of all the territory of Bohemia was in possession of 33 men, while less than 1% was owned by 373,000 peasants. Three-eighths of the population of Bohemia owned no land at all until 1920. Many of the enormous estates were lands confiscated as a result of religious and political wars. With the independence of Czechoslovakia and the end of control by the German and Magyar elements, a comprehensive scheme of agrarian reform was planned. In 1920 the expropriation of all estates of over 475 acres, if cultivated, and of 350 acres, if uncultivated, was ordered. The former owners were to be paid by the new possessors. About 3,250,000 acres of cultivated land and twice that amount of forest were taken over, so that the republic is now a country of moderate-sized and small farms. The yields now are actually larger in spite of the difficulties which inevitably accompany such land reform.

Industry. The country possesses the basic raw materials and power resources for an extensive industrial development. As already stated there is an abundance of bituminous coal and lignite, as well as a great variety of raw materials for all of the food, brewing, glass, porcelain and wood industries. The iron, chemical and leather plants are partly supplied by domestic material. The manufacture of textiles and fertilizers requires the import of some raw material. The most serious deficiency is in iron ore; the low grade of the domestic product requires that the major supply be imported from Austria and Sweden. Of the industrial centers, several have developed a very wide reputation, of which Gablonz is perhaps the best

known. Over 200 glass factories employ about 60,000 people and the product known as Gablonz ware is known in every foreign market. Bohemian hops are highly prized and with local barley serve as a basis for brewing, one of the country's major industries, centered mainly at Plzeň (Pilsen) and Budějovice (Budweis). Steel production, chiefly in the coking-coal district, is comparable in output with that of Italy. The metal industries specialize in agricultural machinery and in the equipment for sugar factories and breweries, while the forests support important paper, pulp, furniture and toy manufactures.

Transportation. Transportation facilities have been greatly influenced by the mountain-plateau character of the topography, the far inland position on the continental divide, and the long east-west extent athwart some of the great transcontinental routes. The great bulk of the foreign trade is by railways in spite of the fact that navigable waters lead both to the north and south. For water traffic the Labe is far the most important. In a recent year freight destined to or from the country used the Danube to the amount of 833,882 tons; the Odra and Labe, 2,709,365 tons. However, as the navigability of the Labe, Vltava, Odra and Morava is limited, it is planned to join the Labe with the Danube, which if accomplished would require 10 years at least. The Versailles Treaty internationalized the Odra, Vltava, Labe and Danube, as well as guaranteed to Czechoslovakia port facilities at Hamburg, Stettin, Danzig and Trieste.

Commerce. The chief imports are cotton and woolen cloths, cereals, machinery, iron goods, fats and oils; the principal exports cotton and woolen goods, wood and coal, glass, iron, iron and iron goods, and sugar. The trade with the United States in 1929 was: imports, 1,089,000,000 crowns; exports, 1,477,000,000 crowns.

Finance. The monetary unit is the crown; its gold value was fixed in 1929 at 44.58 grams of pure gold or 33.75 crowns to the American gold dollar. The budget estimate for 1931 was revenue 9,843,827,500 crowns, and expenditure 9,838,525,200 crowns. The new national bank began business in 1926 with a note circulation of 7,146,000,000 crowns. The note circulation on Aug. 31, 1930 was 6,897,000,000 crowns, reserves in gold of 1,414,000,000 crowns, and in foreign credits, 2,309,000,000 crowns.

Population, Religion and Education. The principal towns are PRAHA, the capital, BRNO, MORAVSKÁ OSTRAVA and PLZEŇ. The republic is a Slavic wedge projected far into middle Europe, with Germans on both the north and south. The Czechs, who constitute the dominant political group, are an able and intelligent people. The main part of the population is made up of two closely related Slavic groups, the Czechs and the Slovaks. There is a considerable alien minority making up more than one-third of the total population; in fact it is estimated that for 90% of its length the boundaries of Czechoslovakia run through non-Slavic population. The most important minority

group is that of the Germans who form a fringe near the border of Bohemia. They and the Hungarians were in political control until the World War, and now constitute a powerful and aggressive element opposed by the newly established régime. The question of minorities has been one of the country's problems. About 76% of the population profess the Roman Catholic faith, the Greek Catholics form over 3%, Protestant sects 7%, the Czechoslovak Church 4%, the Jewish faith 2% and about 6% of the population have not stated their religion. Pop. 1930, 14,726,158. Education is compulsory between the ages of 6 and 14. There are practically no illiterates except in Slovakia and Ruthenia. The universities are Praha, founded 1348, Brno and Bratislava.

Government. The main features of the constitution follow those of France. The President is elected for seven years and may hold office for two consecutive terms. The legislative body is bi-cameral, consisting of a House of Deputies and a Senate. The House of Deputies is made up of 300 members, elected for 6 years; and the Senate, 150 members elected for 8 years. The House of Deputies is the more powerful chamber, for a majority vote of this body can overrule the president's veto, and its vote of a lack of confidence can overthrow the ministry. The system of elections is based on proportional representation.

CZECHOSLOVAKIA, HISTORY OF. The present country is basically the former kingdom of Bohemia and the Margraviate of Moravia, to which have been added the remnant of Austrian Silesia, parts of Prussian Silesia, and the northern part of old Hungary, the last, a land inhabited by Magyars, Slovaks, and Ruthenians.

Bohemia. The upper valleys of the Elbe were occupied by Slavic tribes probably before the 1st century A.D., but their domestic organization and their relations with the neighboring German tribes are obscure. Not until Charlemagne was there any Frankish power in Bohemia and even then Frankish control was too weak to introduce Christianity which entered late in the 9th century, and then from the Byzantine missionary, Methodius. Later, although Bohemia did not follow the Greek Church in the schism with Rome, the influence of the eastern origin of her Christianity was long felt.

During this early period kingdoms of great territorial extent appeared and as quickly disappeared throughout the Slavic lands. For a brief period Bolislav III of Bohemia ruled such a domain but shortly lost it all to Bolislav the Great of Poland. Later Bohemia secured her independence from Poland and became a duchy of the Holy Roman Empire, securing the royal title from the Emperor Henry IV in 1088. During the succeeding century and a half there is little of striking note in the history of Bohemia, but beneath the surface the process of changing vague Slavic tribes into a feudal nation continued. More important still was the slow penetration of German Gothic culture and the increasing settlement of Germans in Bohemia.

The death of the Emperor Frederick II in 1250 and the disorganization of the Great Interregnum proved a temporary opportunity to Bohemia. Ottocar II annexed Austria, Syria, and Carinthia and eventually pushed his dominions to the Adriatic, but the election of Rudolph of Habsburg to the throne in 1273 brought on war in which Ottocar was defeated and stripped of all his southern acquisitions. A few years later the death of Wenceslaus III ended the line of Premyslide kings of Bohemia and left the succession unsettled. After brief reigns of Rudolph of Austria and Henry of Carinthia, John of Luxembourg, son of the Emperor Henry VII was elected in 1310, founding the line of Luxembourg kings under whom Bohemia became one of the great states of Europe. John's son Charles IV was elected Emperor and continuing to reside at Prague, built it into one of the finest cities in Europe and founded the university.

Under Charles' son, Wenceslaus, the long religious and political troubles of Bohemia began. The movement for Church reform was widespread over Europe and although John Hus was burned by the Council of Constance in 1415 his teachings took deep root in Bohemia. Wenceslaus tolerated the Hussites but his death without issue in 1419 threw open both the question of succession and of reform. Wenceslaus' brother, the Emperor Sigismund, claimed the throne but failed to capture Prague from John Ziska who had taken the field at the head of the reform party. Ziska held out until his death in 1431 when Sigismund agreed to a compromise and was allowed to enter Prague as king. Sigismund died in 1437, his son Albert two years later, and during the minority of the latter's posthumous son Ladislaus, the power was taken by the regent George Podiebrad, who on Ladislaus' death in 1457 forced his own election.

Podiebrad was a Hussite and carried on war against the Church, the nobles, and Hungary, but his work was largely undone by his successor, Vladislav, son of the king of Poland, elected 1471, and later likewise king of Hungary, under whom the power of the crown and privileges of the towns were curbed to the advantage of the nobility. Vladislav who was otherwise an unimportant king, married his daughter Anne to the Habsburg Archduke, Ferdinand of Austria, future emperor. On the death without children of his only son Louis in 1526 Ferdinand claimed the crowns of Bohemia and Hungary in the right of his wife. He succeeded to the crown in fact because he had sufficient military strength to force his election, but once in power he established the principle of hereditary succession. Except for the election of Frederick, Elector of the Palatinate, who ruled one winter, a Habsburg monarch ruled in Bohemia until the establishment of the Republic in 1918.

Ferdinand aimed at increasing the royal power and at undermining the Protestants, which the Hussites had become since the spread of Lutheranism in the rest of Germany, but to the latter aim he proceeded cautiously bringing indirect pressure upon them and introducing the Jesuits into Bohemia for propaganda.

His grandson, Rudolph, 1566-1612, took little real interest in the religious quarrels and his policy veered with political necessity. He proclaimed religious toleration in 1609, but the edict was largely ignored by both sides. In 1612 Rudolph abdicated in favor of his pro-Catholic brother Matthias but in 1616 Matthias abdicated and Rudolph forced the election of his cousin, Ferdinand, afterwards emperor. Ferdinand II was a pronounced Catholic and the Protestants of Bohemia rose in revolt. The Defenestration of Prague in which Ferdinand's envoys were thrown from the castle windows was the signal for the outbreak of the THIRTY YEARS' WAR. At first the war swung in favor of the Protestants in Bohemia and the crown was offered to Frederick, Elector Palatine, but in Nov. 1620, at White Hill near Prague, Tilly's army acting for the emperor crushed the Bohemian Protestants and left the country open. It was largely a ruined land that Ferdinand recaptured, and although he reestablished both Catholicism and the royal power his policy was not cruel. In 1627 a new constitution was issued to Bohemia under which the royal succession became strictly hereditary and the autonomy of Bohemia largely disappeared.

For over 200 years Bohemia continued as part of Austria with little independent history of her own. During the 19th century began a nationalistic revival coupled with political liberalism. In 1848 a slight insurrection was put down, but the movement to promote the use of the Czech language gained ground. The attempt, however, to make Austria-Hungary a triple monarchy with Bohemia as an equal member failed, largely because of the vigorous opposition of Hungary.

During the World War Bohemian nationalism revived. The Czechs received encouragement from the allied powers and a promise of independence if the Central Powers should be defeated. A government was organized by the Czech refugees in France and received official recognition. On Oct. 28, 1918 the Czech members withdrew from the Austrian parliament and proclaimed the independence of Bohemia and the government organized abroad was later accepted with Masaryk as first President.

The new state inherited most of the industry of old Austria. It produces considerable coal, some iron, lumber, and beet sugar. It is the home of Pilsner beer, an important metallurgical industry, and textile, shoe, glass and porcelain manufactures. Because of the production of more finished products than it can consume, Czechoslovakia has been forced to sell abroad. Although an inland state, it has access to the sea via the internationalized Danube, the Molda and the Elbe. An excess of exports over imports has been steadily maintained, but the proposed customs union of Austria and Germany in 1931 would have been a severe blow to Czech foreign trade. The "favorable balance" of trade has been facilitated by the fact that Czechoslovakia has a thrifty agricultural system, many of the large uncultivated estates having been broken up into farms not to exceed about 500 acres.

In foreign affairs Czechoslovakia has played a leading rôle as the cornerstone of the Little Entente and as an ally of France. Czech policy has been aimed against the strengthening of Austria or Hungary and the union of Austria and Germany. In domestic matters the main problem has been to harmonize the four nationalities, the Czechs, Germans, Slovaks and Ruthenians, a task that has been in large part accomplished successfully.

Moravia. The history of Moravia differs little from that of Bohemia. Moravia was settled later and lying to the east was more exposed to hostile raids. It was thus attacked by the Avars during the 8th century and by the Magyars during the 10th. In 1029 it was incorporated with Bohemia, but in the 11th century it was created into a Margraviate as an hereditary fief of the Bohemian crown, thereafter passing to the various dynasties which ruled in Bohemia. Moravia was more terribly devastated than Bohemia by the THIRTY YEARS' WAR and the male population was so greatly reduced that for many years bigamy was permitted there.

Silesia. Austrian Silesia which forms part of Czechoslovakia is a mere remnant of the old Duchy which occupied the upper valley of the Oder. In 800 this region was inhabited by Slavs, but by 1400 it had become almost entirely German. During the 11th century it became part of the Kingdom of Poland and so remained until the opening of the 14th century when it passed to the House of Luxembourg, which in 1310 succeeded to the throne of Bohemia. Thereafter Silesia remained a dependency of the Bohemian crown, passing to the Habsburgs in 1526, until most of it was annexed by Prussia in 1742. The remnant, Austrian Silesia, was merged with Moravia until 1849 when it was reestablished as an independent district. It was given to Czechoslovakia at the conclusion of the World War.

L. Br.

See J. Cisar and F. Pokorny, *The Czechoslovak Republic A survey of its history and geography, its political and cultural organization, and its economic resources*, 1922; T. G. Masaryk, *The Making of a State; Memories and Observations*, 1914-18, 1927; L. Pasvolosky, *Economic Nationalism of the Danubian States*, 1928.

CZECHOSLOVAKIAN LANGUAGES, a group of West SLAVIC languages used in Czechoslovakia and comprising Czech, with more than 8,000,000 speakers, and Slovak, with about 2,500,000 in Slovakia and colonies in the United States. The differences between the two are not very great, although Slovak is the more archaic; both accent the first syllable of the word and rigidly distinguish short from long vowels. Czech is closely related to SORABIAN, while the older Slovak forms the connecting link with the South SLAVIC SLOVENIAN.

Czech, divided into Czech proper and Moravian, has literary documents of worth from the end of the 13th century, and until the time of JOHN HUSS, at the beginning of the 15th century, is termed Old Czech. It reached its climax in the 17th century, after which it declined in favor of GERMAN, but enjoyed a revival in the 19th century when it was

cleared of its numerous German and Latin loan-words. Slovak, on the other hand, did not become a literary language until the beginning of the last century, Slovaks formerly having written in Czech.

A. SE.

BIBLIOGRAPHY.—E. Smetánka, *Tschechische Grammatik*, 1914; J. V. Nigrin, *Bohemian Grammar*, 1918; A. Mazon, *Grammaire de la langue tchèque*, 1921.

CZERNOWITZ. See CERNAUTI.

CZERNY, KARL (1791-1857), Austrian music composer and pianist, was born at Vienna, Feb. 20, 1791. He received his first music lessons from his father. After Beethoven heard the youth play he offered to instruct him, and Czerny was his pupil during 1800-03. He also studied with Hummel and Clementi. Public appearances were repugnant to his disposition, and he accordingly devoted himself to teaching. His industry resulted in 900 works for the pianoforte, and he also composed masses and symphonies. His *Études*, familiar to students of the

pianoforte, are his most famous work. He died at Vienna, July 15, 1857.

CZESTOCHOWA, a city and industrial center of the Polish voievodship Kielce, not far from the Silesian frontier. The city has been called the Mecca of Poland, for hundreds of thousands of pilgrims from all parts of Poland and even the neighboring countries visit Czestochowa in the course of a year. On the greatest "days of indulgence," as many as 300,000 pilgrims visit the city. Of special interest is the church and monastery of the Paulines, "Brothers of St. Paul," standing on the hill "Jasna Gora," Light Mountain, and dominating the surrounding country. The church contains the miraculous picture of the Holy Virgin, painted according to tradition by St. Luke. King Wladyslas Jagiello founded the monastery in 1382. The tower of the church is over 330 ft. high and is the highest tower in Poland. In the neighborhood of Czestochowa there are many iron mines. Est. pop. 1930, 115,000.

D

DABCHICK, a name given in North America to the pied-billed grebe (*Podilymbus podiceps*), a common aquatic bird in the eastern United States remarkable for its extreme quickness in diving. See GREBE.

DACCA, the name of a city, district and division in Bengal, British India, situated on the Buri-Ganga River. The city was a provincial capital in the 17th century and the capital of Eastern Bengal and Assam from 1905-12. Dacca contains the noted University, founded in 1921, which annually enrolls 1,500 students. The once celebrated Dacca muslin is now but little manufactured, the chief industry being that of shell-carving. The district of Dacca, partially bounded by the rivers Padma, Meghana and Jamuna, produces rice and jute, gold and silver work and carries on muslin weaving. Area 2,723 sq. mi. The division of Dacca, comprising the districts of Dacca, Akarganj, Mymensingh and Faridpur, has an area of 14,822 sq. mi. Pop. 1921, city, 119,450; district, 3,125,967; 1931, city, 140,477; district, 3,433,103.

DACE, the name of several fresh-water fishes of the carp family (*Cyprinidae*), found in western Europe and in the western and eastern parts of North America. The European dace (*Leuciscus leuciscus*) is small with a stout body. Its coloring, like all the daces, is gray-blue above, shading to white on the under parts. It will take live bait, or a fly, but is not valued as a food fish, except where there is a scarcity of other fishes. The horned dace, or creek chub (*Semotilus atromaculatus*) of the United States, is an excellent bait for larger fish, such as pike, bass, and muskallunge. Conspicuous tubercles appear on the heads of the males during the spring spawning season. Their bellies also assume a pinkish cast. A black spot at the base of the front rays of the dorsal fin, bordered with red in the male, distinguishes the dace.

DACIA, an historic district inhabited by the Daci and Getae, situated between the Danube and Tisa rivers in what is now Transylvania, part of Hungary, Rumania and Czechoslovakia. The Daci were warlike and industrious. They worked gold and silver mines and carried on considerable trade. Conquered by Trajan in 108, Dacia became a Roman province. Roman legions remained until 270 when they were forced to retreat south of the Danube. From the Roman colonists who entered the country the modern Rumanians are descended; the language spoken in the mountains to-day is closely allied to Latin.

DACITE, a group of typically light colored IGNEOUS ROCKS closely resembling the RHYOLITES. The texture ranges from dense and fine-grained, or felsitic, to porphyritic, and sometimes cellular and glassy when in surface flows. The component minerals are QUARTZ,

PLAGIOCLASE feldspars, BIOTITE and frequently HORN-BLENDE and AUGITE, so that the dacites are the fine-grained equivalents of the quartz DIORITES, and therefore might be called quartz ANDESITES. The name was derived from the old Roman province of Dacia, now part of Hungary, where these rocks were studied by Stache in 1863. Dacites are widespread also in the volcanic districts of Central and South America. See also PORPHYRY; PETROLOGY; FELSITE.

DADAISM, a movement in art inaugurated in 1916 in Zurich by Picabia, Tristan Tzara and André Bréton as "a revolt against all preconceived notions of anything whatsoever." The word *dada*, meaning a child's hobbyhorse in French, implies an interest in all extremely primitive or simple modes of expression. It was the Dadaists' contention that everything, including their own movement, was meaningless. Dadaism has been described as a manifestation of the loss of faith and the cynicism which followed the World War.

BIBLIOGRAPHY.—*Art News*, Sept., May, 1920.

DADDY-LONG-LEGS, the name popularly given in America to the harvestman and in England to the crane-fly. The only thing the two creatures have in common is the fact that both possess enormously long legs.

The harvestmen are members of an arachnid order (*Ophioness*) found in tropic and temperate lands. Most species look like spiders (whose distant relations they are) with stilt-like legs and small oval bodies. The legs may be 20 times as long as the body, and contain 50 joints. They break off very easily. If one seizes a harvestman by the leg he will leave it in one's hand and hurry away. To discourage the attacks of enemies harvestmen secrete an unpleasant smelling fluid.

These animals are very common in American woods and fields, and even in suburban backyards in the summer and fall. Their eggs winter in the ground, and generally hatch in the spring.

The crane-flies belong to the order of true flies (*Diptera*), and they are found all over the world. They are two-winged insects which resemble huge mosquitoes. In spring and summer the common English species (*Tipula oleracea* and *Tipula paludosa*) often appear in large numbers. Their life is not long; the male dies after mating and the female dies after depositing her eggs in the ground. These eggs hatch in about two weeks. The larval crane-fly, popularly known as the "leather jacket," is a fat grub. It is a great enemy of the farmers in many parts of Britain as it feeds on the roots of grasses and cereals. A. I. W.

DAEDALUS, in Greek mythology, the first great sculptor and architect. He is said by some to have

been a Cretan, but by others a descendant of Erechtheus, King of Athens. Among his achievements was the construction of the wooden cow for Pasiphae, wife of King MINOS of Crete, the labyrinth for the Minotaur, and the wings which he made for himself and ICARUS, his son. With these they were to fly away from the island, but in flight Icarus passed too near the sun, the waxen wings melted, and he fell into the sea. Daedalus reached Sicily in safety. Many buildings and wooden statues are attributed to him.

DAFFODIL, originally an European bulbous herb (*Narcissus Pseudo-Narcissus*) of the amaryllis family, which in later years has been developed into hundreds of horticultural forms. These are generally called daffodils or narcissus but are closely related to the JONQUIL, from which they differ in having grass-like leaves.

Daffodils are popular garden plants for pot culture or for naturalizing in the lawn where their use is extensive. The typical form always has yellow flowers, often nodding, and comprises, besides the petals, an inner, tubular crown or trumpet. The development of this crown is conspicuous, especially in the trumpet narcissus. N. T.

DAGGATUN, called also Berber Jews, a warlike, nomadic tribe which dwells in the Sahara Desert, near Tementit, Morocco, about the oasis of Tuat. According to its own traditions, the tribe of the Daggatun was of Jewish descent and origin. Despite the fact that the Daggatun to-day practice the same religion and the same customs as the Berber Tuaregs, and that they speak the same language, they still refuse to intermarry with the latter, and carry on constant warfare with them.

The Daggatun have lived in the Sahara Desert ever since the 7th century, according to the report made in 1857 by Rabbi Mordecai Abi Sarur, of Akka, Morocco. Nothing definite is known concerning their former habitat and their actual origin, or concerning the reasons which they adduce in support of their alleged Jewish origin. Rabbi Sarur stated also that the Daggatun dwelt in tents, were of a lighter complexion than the rest of the Jews of Africa, and that they first settled in the Sahara Desert towards the end of the 7th century, although he tells nothing of their origin. After a time, under Abd al-Malik, they were exiled to the desert of Ajaj for refusing to accept Islam. Later they gradually came to forget their Jewish practices, and became nominally Mohammedans, although they preserved a strong consciousness of their Jewish origin. A. Sh.

BIBLIOGRAPHY.—H. S. Morais, *The Daggatun*, 1882; Gossy, *The Lost Ten Tribes*, 1930.

DAGUERRE, LOUIS JACQUES MANDE (1789-1851), French inventor and photographer, was born at Cormeilles, Seine-et-Oise, Nov. 18, 1789. He began his career as a scene-painter, and in 1822 exhibited the Diorama, an illuminated canvas which could reproduce the light effects of the sun and moon. This led him to study the action of light

on sensitized plates, and in 1839 he announced his discovery of a means of photographic printing, later known as the Daguerreotype process. Although Daguerre and the scientist J. N. Niepce had succeeded in fixing a portrait on a silver-coated copper plate, they had been unable to find a developer until Daguerre accidentally discovered that mercury was an agent. He was awarded a pension by the French government for his work. He died at Petit-Brie, near Paris, July 10, 1851.

DAHLGREN, JOHN ADOLF (1809-70), American naval officer, was born in Philadelphia, Nov. 13, 1809, and became midshipman in the navy in 1826. He was assigned to the coast survey in 1834 and to the Ordnance department in 1847, where he established an Ordnance workshop and invented the Dahlgren navy gun, a smooth-bore, cast-iron piece which was widely used until 1880. He served in the Civil War as commandant of the Washington navy yard, and later head of the Ordnance bureau. He became a rear admiral in 1863, and assumed command of the South Atlantic Squadron. After the war he was assigned to the command of the South Pacific Squadron (1866-68), after which he returned to the Ordnance bureau and lastly to command of the Washington navy yard. He died at Washington July 12, 1870.

DAHLIA, named in honor of the Swedish botanist, Andreas Dahl, a genus (fam. *Compositae*) of Mexican tuberous-rooted perennial herbs which take leading rank as late summer outdoor flowers. Cultivation has so modified the 10 or 12 species that bota-

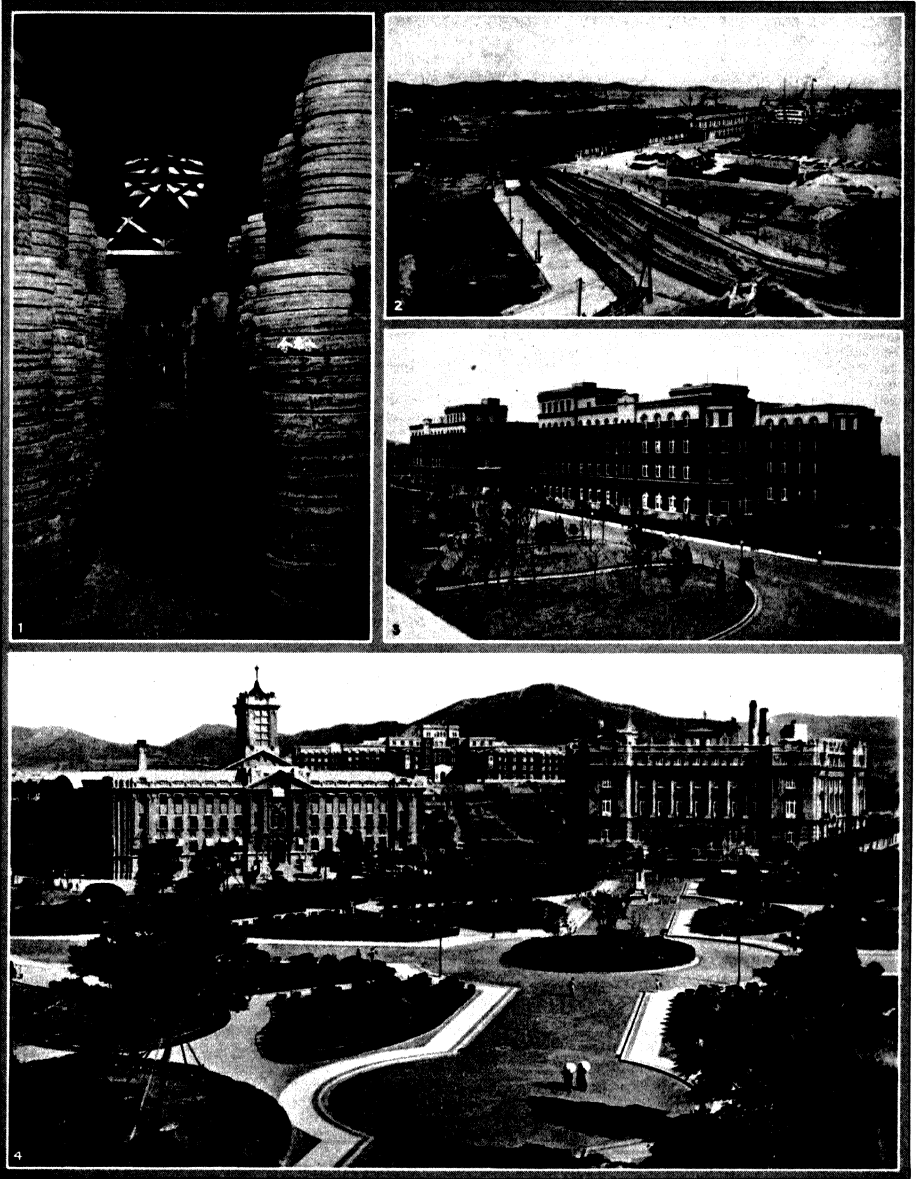


COURTESY AMER. MUS. OF NATL. HISTORY
CLYDE FISHER DAHLIA

nists differ as to which are progenitors of modern varieties, though most show characteristics of the common garden dahlia (*D. pinnata*) or of the cactus dahlia (*D. juarezii*).

Among important garden flowers the dahlia is of comparatively recent introduction. It appeared in cultivation in 1789 as a single flowered plant. Twenty-five years later double varieties appeared and during

DAIREN



COURTESY SOUTH MANCHURIA RAILWAY

THE MODERN PORT OF DAIREN, MANCHURIA

1. Bean cakes in storage on the Dairen wharves. Soy beans are an important Manchurian crop. 2. Dairen wharves.

3. Dairen Hospital, constructed under American management at a cost of \$4,000,000. 4. Central Circle, Dairen.

the following quarter century the dahlia gained a leading place among garden plants. Many thousand varieties are now carried by American seedsmen and specialists and exhibitions are held annually under the auspices of dahlia societies and garden organizations in many American cities. Until the introduction of modern forms, the dahlia suffered in popularity because of the prejudice against the stiff, globular type of bloom that characterized the varieties grown during the Victorian era. This bias against them has largely disappeared since the introduction of less formal types, especially the cactus, collarette, peony-flowered and decorative classes, all of which are looser, flatter and more chrysanthemum-like in freedom of form.

Dahlias are propagated by seeds when new varieties or mass effects are desired, regardless of form or color. The best resulting from seed may be saved



COURTESY N. Y. BOTANICAL SOCIETY

DAHLIA ROOTS
Dahlia variabilis

for the following year when the clumps of tubers may be broken apart, each tuber to possess at least one "eye." To assure this the clumps may be kept moist and warm during early spring to start the buds. Shoots developed from these may be used as cuttings, rooted in sand, potted and transplanted outdoors after danger of frost has passed. Dahlias thrive in any soil but must have ample sunlight and air movement. They must also be protected from high wind, preferably by tying to stout stakes. M. G. K.

DAHOMÉY, a French colony on the west coast of Africa between Nigeria and Togoland, with an area of 41,302 sq. mi. The natives are pure Negroes of the Ewe group and are good agriculturists. Palm kernels and palm oil provide almost all the exports. Experiments, encouraging in their results, have been made with coffee, cocoa, vanilla, cotton and kapok. The development of the colony, however, is at its beginning, the pacification of the country having been achieved only at the end of the 19th century.

By 1724 the Kingdom of Dahomey, which dates

from the first years of that century, was a powerful state. Widespread human sacrifices took place at religious and state ceremonies until 1876, when Britain blockaded the coast. The French dictated terms to the king in 1892, and in 1894 annexed the country. Porto Novo, with a population of 27,000, is the administrative center. Abomey was the capital of the native kingdom. Pop. 1929, 1,080,447; of this number 1,093 were Europeans.

DAHON (*Ilex Cassine*), an evergreen shrub or small tree of the HOLLY family found in the southern United States, the Bahamas and Cuba, and often planted for its handsome foliage and fruit. It bears finely toothed leaves, 2 to 3 in. long, and inconspicuous flowers. The small, round, red or rarely yellow, berry-like drupes, which ripen late in the autumn, persist on the branches until spring.

DÁIL EIREANN, the popular body in the bicameral legislative system established for the Irish Free State by the Constitution of 1922. It is the successor of that famous National Parliament organized in 1906 by ARTHUR GRIFFITH which was extralegal in its origin and Sinn Féin in its sentiments. Under the Presidency of EAMONN DE VALERA, by a vote of 64 to 57 it ratified the treaty creating the Free State and called the convention which drew up the Constitution. De Valera and 33 others who were elected refused to attend because of their opposition to the settlement; but the work of the Convention was approved by a royal proclamation of Dec. 6, 1922.

Article 12 of this Constitution placed legislative power in the Crown and two houses (Oireachtas), consisting of a Senate, or Senad Eireann, and a Chamber of Deputies, or Dáil Eireann. Both houses can initiate bills; but all fiscal measures must originate in the Dáil. Legislation approved by that body becomes law, even though the Senate is opposed, in 270 days. The members of the Dáil, elected by all citizens over 21 years of age, represent constituencies of not less than 20,000 and not more than 30,000 people. There are 154 deputies who sit for six years; but dissolution may take place at any time on the advice of the Executive Council. This body, consisting of not more than seven and not less than five ministers, is chosen from the Dáil and is responsible to that body. From 1922-32 WILLIAM COSGRAVE headed the Government. The Opposition formed by a coalition of Republicans (Fianna Fail) and Laborites has been led by De Valera. The Republicans for long abstained from attendance because of the required oath of allegiance to the Crown but since 1927 they have participated and in the general election of Mar. 1932 they replaced the Cosgrave Ministry. S. P. O'B.

DAIREN (*Dalny*, and also *Talien*), the leading port of Manchuria, and the second largest port of China, situated at the southern end of the LIAOTUNG PENINSULA. Dairen was a small fishing village on a magnificent harbor until the Russians, in 1898, secured a lease of the southern end of the Liaotung Peninsula and proceeded to develop it as a commer-

cial port and the southern terminus of the CHINESE EASTERN RAILWAY. They called the city Dalny. When the Japanese secured control of this territory as a result of the RUSSO-JAPANESE WAR of 1904-5, they pushed forward rapidly the development of the port facilities of the city, and changed the name to Dairen. The port is now one of the two or three best equipped and busiest harbors in the Far East. Its trade has increased from approximately \$25,000,000 in 1908 to approximately \$300,000,000 in 1930. The principal exports consist of the agricultural and mining products of MANCHURIA, the most important single item being soya beans and bean products. More than half of the Dairen trade is with Japan, the next largest amount being with China Proper. Dairen has been a free port since 1906, with a branch of the Chinese maritime customs collecting duties on goods passing across the boundaries of the area to and from Manchuria territory. It is the principal center of Japanese commercial activity in Manchuria. Pop. 1929, approximately 250,000.

DAIRY BARNs have been developed to the extent that a dairy cow is nearly as comfortable in the winter and produces almost as much milk as while on pasture in the spring. These barns are usually rectangular structures with stalls arranged in two rows lengthwise of the building. The cows generally face toward the side walls so that the milking machine can be operated from one alley. This alley may serve as a driveway for the removal of manure.

Hay is stored above the stable while a silo and feed room are adjacent to it. A concrete floor and concrete mangers and gutters make it easy to keep the animals clean, and drinking troughs and movable stanchions provide for the comfort of the cows. Litter and feed carriers and milking machines make the work easy and keep the milk clean. High standards of sanitation are maintained in the up-to-date dairy barn. *See also* **BARNs**. H. B. W.

BIBLIOGRAPHY.—W. A. Foster and D. G. Carter, *Farm Buildings*; Farmers' Bulletin 1342, *Dairy Barns—Construction*.

DAIRYING, or dairy husbandry, the branch of farming that deals with milk production and utilization, includes farming systems and crop growing connected with dairy animal feeding, the breeding of such animals and management of milch cows, the ventilation and sanitation of stables and the handling and manufacture of milk and cream.

Although originally and still a department of general farming, dairying has developed commercially along several lines which differ widely from those practiced on farms. The principal of these are sale of milk and cream as such by milkmen direct to consumers, manufacture of cheese from whole milk and of butter from cream. In the first case no part of the milk returns to the farm. When cheese or butter are made on the farm the waste products, skimmed milk, buttermilk and whey, are retained and fed to livestock and poultry. When only the cream is sold for butter or ice-cream making, the skimmed milk may be retained or returned as buttermilk to the

farm or it may be used to manufacture casein or sugar-of-milk or both. When whole milk is sent to the cheese factory the whey may be returned or made into the same products.

Until toward the close of the 19th century dairying was restricted to those months when pasturage was available. In order to have abundance of milk during this period calving was planned to occur in spring and the cows were dried up in early winter. This is because cows were poorly housed, poorly bred and fed. It was also believed that natural conditions limited dairying to a dairy belt. It is now conducted throughout the year wherever climate and soil permit fodder production.

Dairying made greater progress during the last half of the 19th century than any other branch of farming, and greater than during all the previous centuries. It is the most highly developed and, when properly managed, the one best calculated to maintain soil fertility. During the growing season the cows are either pastured or soiled, in each case with more or less grain. In the winter they get hay and succulent fodder, silage, root crops or both with corn meal, bran, or by-products from cereal manufacturing. In the pasturage system the animals forage during summer and are driven into yards or barns to be milked and fed grain. In the soiling system they have exercising yards but get all their feed in their stalls. By this method costly land can be utilized to better advantage than by the pasturage system, crops being cut successively.

Although better methods of feeding and care deserve credit for much of the improvement and development, the most important single factor is the Babcock test for butter fat. (*See* **CATTLE RAISING**) By means of this each cow can be valued according to the quantity of milk and the percentage of butter fat she produces. Application of this test enables dairymen to discard unprofitable animals, thus developing herds whose production of milk and butter is far greater than those of their predecessors, and establishing legal standards of milk and cream based upon stipulated fat content.

The sciences have taught the necessity of cleanliness and led to the enactment of laws that maintain high standards in the production and handling of milk and milk products. Modern stables are roomier, lighter, better ventilated and cleaner than were formerly found. Cows are healthier, more thrifty and productive. Their feed of better quality is supplied more liberally. Newly drawn milk is strained, cooled and aerated to dissipate animal and stable odors; then it is placed in cans, bottles or glass-lined tanks, trucks or railway cars and kept cool until delivery, which often takes place after a journey of 24 to 36 hours to consumers in the cities. Bacteriology has played a leading rôle in these developments and taught how milk may be kept for longer periods than formerly through the practice of pasteurization. It has also greatly aided dairying in butter making by means of starters added to cream. These are pure cultures

of desirable bacteria that prepare the cream for churning and establish standard flavors in both butter and buttermilk.

MILK COWS ON FARMS, U.S.
5-Year Average, 1927-31

Division	Value per Head	Number	% of Total
UNITED STATES	\$71 82	22,179,000	100.0
LEADING STATES:			
Wisconsin	82.80	2,026,000	9.1
Minnesota	70.40	1,501,000	6.8
New York	106.20	1,360,000	6.1
Iowa	74.00	1,327,000	6.0
Illinois	77.20	982,000	4.4
Texas	50.20	961,000	4.3
Ohio	79.00	919,000	4.1
Pennsylvania	95.00	872,000	3.9
Michigan	83.40	861,000	3.8
Missouri	59.40	849,000	3.8

The invention of mechanical devices has kept pace with science in handling and manufacturing milk. The most revolutionary of these, however, is the separator, a machine by which cream is taken from newly drawn milk without having to rise. It saves time and all the labor connected with the pan methods. The apparatus takes advantage of centrifugal force and the difference in specific gravity between butter fat and the heavy constituents of milk to separate these two. The modern machine consists of a cylindrical bowl filled with downward deflected pans, set at slight distances apart. When revolving at high speed the heavier milk constituents are thrown outward and downward to the margin of the bowl whence they rise and pass out of the machine as skimmed milk. The lighter butter fat makes its way inward and upward through a central aperture to another exit whence it issues as cream. By varying the speed the operator may vary the thickness of the cream. With small hand machines 200 to 400 lbs. of milk can be separated in an hour; power machines handle ten times these quantities. Properly operated, machines leave less than a tenth of 1% of butter fat in the skimmed milk. M. G. K.

DAIRY MACHINERY. The principal machines used in dairy plants are pasteurizers, holders, coolers, separators, clarifiers, homogenizers, vacuum pans, milk powder machinery and ice cream freezers. The pasteurizer is a specially designed heater. Two types are used, the continuous and batch. In the continuous pasteurizers the milk passes through the machine in a continuous stream and is heated quickly to the required temperature, whereas in the batch pasteurizer a large volume of milk is placed in a vat where its temperature is gradually raised.

A holder retains the milk at approximately pasteurizing temperature for a definite period of time. The destruction of bacteria when held at a temperature 145° F. for 30 min. is as great as or greater than when heated to a temperature of around 165° F. in a few seconds, and at the lower temperature there are no material physical or chemical changes.

Milk coolers include the internal-tube counter-cur-

rent cooler and the surface cooler. The former consists of a small tube inside a larger one. The warm milk passes through the inner tube and the cooling medium passes in the opposite direction through the annular space between the inner and outer tubes. In the case of the surface cooler the warm milk passes downward over a series of parallel tubes and the cooling medium passes through the tubes in an upward direction.

Separators and clarifiers are very similar in their design and depend for their action on centrifugal force. The constituent parts of milk and foreign materials are readily separated out, due to their varying densities. Homogenizers are simply specially designed, single acting, high-pressure pumps. Their function is to break down the fat globules in the milk or cream, thus giving a greater dispersion of the fat throughout the mass and apparently producing greater viscosity. In breaking down these globules the milk or cream is forced through hardened steel dies at a pressure of thousands of pounds per square inch.

The vacuum pan concentrates milk by evaporating a portion of the contained water under a vacuum, operating at a comparatively low temperature which will not injure the product. They usually operate at about a 27 in. vacuum and a corresponding evaporating temperature of 115° F.

Milk powder machines are of the hot-air and the hot-roll types. In the hot-air type the milk is sprayed into hot, dry air which rapidly takes up the water from the milk, leaving the solids in the form of a powder. The hot roll type consists of two highly polished hollow internally heated rolls arranged for accurate adjustment of the space between them. The milk is delivered to the rolls from above and passes in a thin layer between them, is quickly dried and scraped off by adjustable knives.

Ice cream freezers are of the batch and the continuous types. With the batch freezer a definite quantity of mix is placed in the hopper, passed into the freezer and frozen in from 5 to 15 min. In the continuous type the refrigerant is evaporated directly in the freezer. The mix is pumped continuously to the freezer by means of a specially designed pump which also delivers air to give the desired over-run. The mix is forced, in a thin layer at a high pressure and velocity, over the freezing surfaces; consequently, the freezing takes place very quickly, resulting in the formation of minute ice crystals, and, hence, a smooth-textured cream. The latest developments in the hardening of ice cream consists in subjecting the cartons of cream to an air blast having a temperature of -35° to -55° F., for from 30 to 60 min.

J. T. B.

DAISY, the name given to various plants of the composite family with ornamental flowers. The true or English daisy (*Bellis perennis*), a garden favorite, described by Burns as a "wee, modest, crimson-tipped flower," grows wild throughout Europe and Asia, and is widely naturalized in North America. It is a small perennial with tufted basal leaves bearing solitary flower heads composed of white or pink-tinged rays

surrounding a yellow center. Among other plants called daisy are the Michaelmas daisy (*Aster* sp.), the ox-eye daisy (*Chrysanthemum Leucanthemum*), and the Shasta daisy (*C. maximum*).

DAKAR, a naval station and seaport of Senegal, on the southern side of Cape Verde, on the bay of



OX-EYE DAISY

Goree. The port has safe anchorage for ocean vessels and splendid docks. A railway runs to the interior. In ten years, 1910-1920, trade increased sixfold. Dakar became the seat of the general government of FRENCH WEST AFRICA in 1903. Pop. 40,152, 2,488 Europeans.

DAKIN'S SOLUTION. See CHLORINATED SODA, SURGICAL SOLUTION.

DAKOTA, the most numerous and perhaps most widely known tribal group of the North American Indian Siouan linguistic stock. The Dakota were divided into seven groups known as the seven council fires: the Santee division or Mdewakanton, Wahpeton, Wahpekute, Sisseton; the Yankton division, the Yanktonai and the Teton. These major groups are in turn subdivided into bands. The Teton, the largest, was subdivided as follows: upper and lower Brulé, Oglala, Sans Arc, Sisasapa or Blackfoot, Miniconjou, Two Kettle, Hunkpapa, etc. Dialectically the Dakota



FROM MAXIMILIAN VON WIED-NEUWIED'S ATLAS

A HORSE RACE OF THE DAKOTA INDIANS
From a drawing by Karl Bodmer

may be classified into four groups: the Santee, Yankton, Teton and Assiniboin. The latter is, however, a separate tribe. When first encountered the Dakota, presumably in their original habitat, occupied North and South Dakota, southern Minnesota, southern Nebraska and western Montana. Now they occupy reservations in North and South Dakota and Montana. Culturally all the Dakota tribes were closely similar, except for the more easterly groups which cultivated corn and lived in bark houses, instead of the typical Plains tipi. The Dakota were typical nomads of the Plains, hunted the buffalo, made their clothing of skin, lived in tipis, laid stress on deeds

of honor and feather heraldry, observed the sun dance, and maintained a series of warrior societies with elaborate rituals. The Dakota, always a powerful group, numbered more than 30,000 in 1931.



FROM MAXIMILIAN VON WIED-NEUWIED'S ATLAS

DAKOTA INDIANS

The Dakotans exposed their dead to the wind and rain on an elevated platform. (From a drawing by Karl Bodmer)

D'ALEMBERT. See ALEMBERT, JEAN LE ROND D'.
DALHOUSIE UNIVERSITY, at Halifax, N.S., Canada, a coeducational and non-sectarian institution, founded in 1818 by the Earl of Dalhousie, and granted university powers in 1841. In 1928 the university added to its curriculum a course leading to the degree of B.Sc. (Fisheries) for the training of scientific men for the advancing of the fishing industry. Dalhousie has an endowment of \$2,506,899, and the library contains 55,000 volumes. In 1930 there were 970 students, and a faculty of 144 headed by Pres. ARTHUR STANLEY MACKENZIE.

DALIN, OLOF VON (1708-63), Swedish poet, was born at Vinberg, Aug. 29, 1708. He studied under a relative, Bishop Rydellius, and Linnaeus, the celebrated botanist, was his fellow pupil. Dalin was ennobled in 1751 and made a Privy Councillor two years later. He founded a weekly journal called *The Swedish Argus* and wrote *Thoughts about Critics*, two satirical allegories, *The Story of the Horse* and *April Work of Our Glorious Time*, and a didactic epos, *Swedish Liberty*. He was for a time tutor to the Crown Prince, afterward Gustavus III. Queen Louisa Ulrika appointed him Secretary of the Swedish Academy of Literature, which she founded. In 1756 Dalin lost his tutorship because he was suspected of having taken part in an attempted *coup d'état*, and was exiled. While in exile he wrote a *History of the Swedish Kingdom*. He was restored to royal favor in 1761 and again took his place at court. Besides the works already mentioned, Dalin wrote *The Jealous Man*, a comedy, and *Brynhilda*, a tragedy. He died at Drottningholm, Aug. 12, 1763.

DALLAS, ALEXANDER JAMES (1759-1817), American public official, was born in Jamaica, B.W.I., June 21, 1759. He became an American citizen in 1783, and began a law practice in Philadelphia.

Jefferson appointed him United States District Attorney for eastern Pennsylvania in 1800, in which office he remained thirteen years. In 1814 Madison appointed him Secretary of the Treasury, and his first acts were to recommend doubling the direct tax and the postal rates, and the organization of a national bank. In two years he raised the treasury from bankruptcy to a point where the government had a surplus of \$20,000,000. For several months in 1815, Dallas was acting Secretary of War. He died at Trenton, N.J., Jan. 14, 1817.

DALLAS, GEORGE MIFFLIN (1792-1864), American diplomat, was born in Philadelphia, July 10, 1792. After graduating at Princeton in 1810, he entered his father's law office, and immediately became active in politics. He served as attorney for the eastern Pennsylvania district, 1829-31, under President Jackson, and was minister to Russia, 1837-39. In 1844 he was elected Vice-President under Polk. He took an active interest in the tariff, but could not reconcile his belief in a high protective tariff with his party's policy of revision downward. President Pierce made him minister to Great Britain in 1856; the Civil War ended his career as a Democrat, and he came home in 1861. He died in Philadelphia Dec. 31, 1864.

DALLAS, a city in northeastern Texas, the county seat of Dallas Co. It is situated on Trinity River, 30 mi. east of Fort Worth, and is served by bus and truck lines and numerous railroads. Love Field is the municipal airport. The city is on four transcontinental roads. Dallas is one of the most modern cities of the southwest. It has many skyscrapers and possesses an abundant water supply, enough for four times its inhabitants. Large gas and oil fields lie in the neighborhood. In 1929 the total industrial output was worth about \$142,000,000. The manufactures include cottonseed oil products, machinery, oil well supplies, refined petroleum, printed matter and farm implements. In 1929 the wholesale trade proper amounted to \$393,242,678; the retail, to \$181,234,364. The city is the seat of the Southern Methodist University, the University of Dallas and the medical, nursing and pharmacy departments of Baylor University situated in Waco. Every year the Texas State Fair, chiefly exhibiting livestock, is held here. The site of Dallas was settled in 1841 and until 1845 was known as Peter's Colony. The city was incorporated in 1871. Pop. 1920, 158,976; 1930, 260,475.

DALLES. See **THE DALLES**.

DALLIN, CYRUS EDWIN (1861-), American sculptor, was born Nov. 22, 1861, in Springville, Utah. He studied for a year under Truman H. Bartlett of Boston and in 1889 went to Paris where he was the pupil of **HENRI CHAPU** and **Dampst**. Dallin is best known for his Indian equestrian statues. Outstanding are four related statues depicting the Indian's reaction to the invasion of his land by the whites: *The Signal of Peace* in Lincoln Park, Chicago; *The Medicine Man* in Fairmount Park, Philadelphia; *The Protest* which has not been permanently placed, and the

Appeal to the Great Spirit at the entrance to the Boston Museum of Fine Arts.

DALLING, WILLIAM HENRY LYTTON EARLE BULWER, BARON (1801-72). See **BULWER, WILLIAM HENRY LYTTON EARLE, LORD DALLING**.

DALMATIA, at one time a Crown land of Austria, since the World War part of YUGOSLAVIA. It is a long, narrow coast on the Adriatic between Italy and Albania with mountains towering behind. The projecting mountains, peninsulas and tongues of land form straits and bays which, despite the steepness of the coast, facilitate shipping. It embraces also 20 large and numerous small islands. There is little agriculture, but wine and oil are exported, almonds, melons, figs and pomegranates flourish, as do the maraschino cherry, tobacco and chrysanthemum, from which insect powder is made. The population is almost entirely of the Serb-Croatian race with a few Italians in the cities. In ancient times an independent country, Dalmatia was subdued by the Romans under Augustus and made part of *Illyricum*. Occupied later by the Goths and in 590 by the Avars, it fell in 620 into the hands of the Slavs, whose state broke up at the end of the 11th century, whereupon part of the country was conquered by Hungary in 1102 and the rest, called later the "Duchy" of Dalmatia, placed itself under the protection of the republic of Venice, from which later the Turks conquered a part. Venice, however, recovered the entire territory in 1699 and 1718 with the exception of the republic **RAGUSA**, which lost its freedom through the French in 1808. Dalmatia was placed under Austrian rule by the Peace of Campo-Formio in 1797, was made part of the Kingdom of Italy in 1805, of Illyria in 1809, of Austria again in 1814 and by the Treaty of Rapallo in 1920, of Yugoslavia. On October 3, 1929, the Dalmatian boundaries were abolished by King Alexander I in dividing the kingdom into nine new *banovines* or provinces. Pop. 1920, 621,429.

DALMATIAN, an almost extinct Romance dialect formerly spoken along the eastern coast of the Adriatic, and the source of most of the Latin element in the ALBANIAN vocabulary. Its words closely resemble RUMANIAN, but it changes Latin *c* to *k* (*k* pronounced like *ky* in *Kyoto*) before *e* and *i*, e.g., Latin *centum* = Dalmatian *kint*, "hundred," and Latin *u* has the value of *ü* (French *u*), as Latin *virtute* = Dalmatian *vertut*, "virtue."

BIBLIOGRAPHY—M. G. Bartoli, *Das Dalmatische*, 2 vols., 1906.

DALMATIC, a silk outer vestment with short sleeves and slit at the sides, worn by the deacon at the Mass. It was introduced in earlier form by Pope Sylvester I in 320. The dalmatic follows the prescribed liturgical colors. It was also a bishop's vestment, as well as a coronation robe of the German emperors, as is evidenced by the famous imperial dalmatic at St. Peter's in Rome.

DALNY. See **DAIREN**.

DALOV, JULES (1838-1902), French sculptor, was born Dec. 21, 1838, in Paris. He studied under



COURTESY H. M. OF ART

DALMATIC OF VELVET WITH EMBROIDERED ORPHREYS
Flemish, 15th century

Abel de Pujol, Duret and Carpeaux. Dalov was forced to flee to England during the Commune in 1871 and while there served as master of modeling classes in South Kensington. He greatly admired Rubens and aimed to incorporate realism and the feeling of flesh in his sculptures. His *Triumph of the Republic* in the Place de la Nation, Paris, and the statue of *Silenus* surrounded by Bacchanalian figures in the Luxemburg gardens are famous. Politically, Dalov was a socialist and was at work on a great monument glorifying labor at the time of his death in 1902.

DALTON, JOHN (1766-1844), English chemist, was born at Eaglesfield, Cumberland, Sept. 5, 1766. In 1793 he was lecturer in mathematics and science at Manchester. In 1808 he began his *New System of Chemical Philosophy* which had a powerful influence upon the development of that science. Dalton investigated gases and formulated Dalton's Law of partial pressure of gases and vapors. His greatest work was the establishment of the atomic theory. He also worked upon problems of organic chemistry and amino-acids. He died at Manchester, July 27, 1844.

DALTON, a city in northwestern Georgia, the county seat of Whitfield Co., 40 mi. southeast of Chattanooga, Tenn. Bus and truck lines and two railroads afford transportation. The city is a trading and shipping center for the cotton, grain, fruit and live stock grown in the splendid agricultural region. Cotton mills afford the city its chief industrial activities. Dalton was founded in 1848 and incorporated in 1874. During the Civil War the Confederate forces retreated to Dalton after the fall of Chattanooga; and from here Gen. Joseph E. Johnson in 1864 attacked Sherman's army, but was forced back 15 mi. south of Dalton. Pop. 1920, 5,222; 1930, 8,160.

DALTON, a town and village in Berkshire Co., northwestern Massachusetts. The village is situated about 5 mi. northeast of Pittsfield, on the Boston and

Albany branch of the New York Central Railroad. It has a textile mill and several paper mills which manufacture the paper used for United States currency, and also for bank notes, bonds and records for several foreign countries. Dalton was founded about 1745 and incorporated in 1784. Pop. 1920, 3,752; 1930, 4,224.

DALTON'S LAW, a principle of physics which states that in any mixture of gases which do not react upon each other, the total pressure is equal to the sum of the pressures which the individual constituents would exert at the same temperature if each filled the containing vessel separately. This is also called the *law of partial pressures*. In chemistry, the law of multiple proportions is sometimes called Dalton's Law.

DALY, JOHN AUGUSTIN (1838-99), American playwright and producer, was born at Plymouth, N.C., July 20, 1838. In 1859 he became drama critic for the New York *Sunday Courier*, later serving in a similar capacity on other New York newspapers. He began writing for the theater by adopting von Mosenthal's *Deborah*, which he entitled *Leah the Forsaken*, 1863. His first successful play, *Under the Gaslight*, was produced in 1867. Two years later he opened the Fifth Avenue Theatre, in New York City, and in 1879 he organized Daly's Theatre on Broadway. Mr. Daly had in his repertory company at various times many of the best-known actors and actresses in America. With his company, headed by ADA REHAN, he made several European tours, and in 1893 opened Daly's Theatre in London. His Shakespearean and other classical revivals received fulsome praise. The many plays which he wrote or adapted include *Divorce*, *Pique*, 1875, *Seven-Twenty-Eight*, 1883, *The Great Unknown*, 1889, *The Last Word*, 1890, *Frou-Frou*, *Article 47*, *The Lottery of Love* and *Demise*. He died at Paris, June 7, 1899.

DALY CITY, a residential suburb adjoining San Francisco, in San Mateo Co., western California, served by the Southern Pacific Railroad. It is the center of a fertile agricultural region. Daly City has increased in population more than 100% in the last decade. The city was incorporated in 1911. Pop. 1920, 3,779; 1930, 7,838.

DAMAGES, briefly, a compensation, in money, for injury received. A statutory definition in the California code states: "Every person who suffers detriment from the unlawful act or omission of another, may recover from the person in fault a compensation therefor, in money, which is called damages." Similar definitions generally hold in other states. In addition to actual compensation, at COMMON LAW and in some states punitive damages are awarded in case of wanton and wilful injuries, giving the recipient an extra amount to deter others from committing such injuries.

Direct damages are those which result without the intervention of intermediate cause. *Consequential damages* result from some act which, although remote and not actionable in itself, is responsible for the resulting injury to the person claiming damages. See also DOUBLE DAMAGES.

DAMAN, a town of Portuguese India, capital of the Damam settlement. It is situated at the mouth of the Damanganga River, about 100 mi. north of Bombay, with which it is connected by rail. Formerly Damam enjoyed considerable commercial prosperity and was particularly noted for its woven fabrics. But with the decline of Portuguese influence in the East it lost its prosperity. The chief industries now are fishing, boat-making and the weaving of mats and blankets. The province produces rice, tobacco and wheat, but none of it is exported. The town has been in continuous Portuguese possession since 1558. The settlement comprises a territory of 149 sq. mi. Pop. about 50,000.

DAMASCUS, capital of the Syrian state located about 180 mi. from Aleppo and 60 mi. from BEIRUT. The plain in which the city lies is irrigated by the waters of the Barad and is covered with extensive gardens and orchards. Some of the narrow streets are covered with roofs. About 70 of the 300 mosques in Damascus are being used at present. The Om-miad, dating from the 8th century and possibly superimposed upon a Christian church, figures in Arab literature as one of the wonders of the world. The bazaars of Damascus are celebrated throughout the Near Eastern world, but the city has lost its prestige as the proud emporium of the Levant trade owing to the construction of the Suez Canal and the commercial ascendancy of modern Alexandria. It still excels, however, in the making of finished articles of oriental handicraft. Beautiful gold and silver embroidered stuffs, jewelry, metal wares and ornamented saddles and bridles are the chief manufactures. Trade is carried on in plums, grapes, dates and rose water. The making of Damascus blades was discovered here and has become famous.

One of the holy cities of the Mohammedan world, Damascus is the gathering point of the Mecca pilgrims. Upon their return from Mecca the pilgrims disperse at Damascus. In the 9th century it was the capital of the early Jewish kings. Under Rome Damascus enjoyed prosperity; in the 7th century the Om-miad caliphs made it their capital and during the World War, Oct. 1918, the allied forces captured the city from the Turks. Many political disturbances followed, but in 1925 it was proclaimed the capital of the Syrian State. Pop. 1929, 193,912.

DAMASUS, name of two popes. St. Damasus I, 366-84, a Spaniard, was a defender of the faith against the Arians, helped promote the Vulgate version of the Bible and wrote numerous Latin epigrams, which are extant. His antipope was Ursinus. Damasus II, placed on the papal throne by Emperor Henry III, reigned but 23 days in 1048.

DAMIEN, JOSEPH (1840-89), Catholic missionary to the lepers of Molokai, was born Joseph de Veuster, at Tromeleo, Belgium, Jan. 3, 1840. After his education at Braine-le-Comte, he entered the novitiate of the Fathers of the Sacred Heart of Jesus and Mary, at Louvain, adopting the name of Damien. Ordained a priest at Honolulu, Hawaii, in 1864, he

served various island parishes until 1873, when he obtained permission to become priest to the leper colony on the adjacent island of Molokai. Here he cared for the lepers, dressing their ulcers, helping them build their cottages and in other ways, until he contracted the disease himself in 1888, dying at Molokai, Apr. 15, 1889. A letter from Robert Louis Stevenson, defending the character of Father Damien, is famous in the annals of heroism.

DAMIETTA, a city of Egypt, on a branch of the Nile, about 6 mi. from its mouth and 125 mi. north-east of Cairo by rail. The ancient town stood about 5 mi. nearer the sea. Damietta, called the Venice of the delta, is unlike other Egyptian towns in that its houses rise from the water's edge, with wharves and steps before them. The heavy winter rains have made it necessary to use burnt brick in the buildings, and this adds color to the walls. The city, although retaining its picturesqueness, has fallen from its old estate, Alexandria having taken most of its former trade. Pop. 1927, 34,907.

DAMOCLES, a flatterer and sycophant of Dionysius the Elder of Syracuse, Sicily. Dionysius, whose lot Damocles invariably professed to envy, invited him to a sumptuous banquet and told him to enjoy to the full the pleasure of being the tyrant of Syracuse. Looking up, the unfortunate Damocles saw a keen-edged sword hanging directly over his head, the weapon suspended only by a hair. Damocles' Sword thus refers to a perilous position or a dreaded evil.

DAMON AND PYTHIAS (or "Pinthias"), two men of ancient Syracuse, famous for their friendship. The loyal Damon takes Pythias's place in prison that his friend may visit home and family before he is put to death. Dionysius the Tyrant, touched by this noble deed, pardons Pythias.

DAMP, gas that forms in coal mines. Fire damp is marsh gas, or METHANE. Mixed with air, it is highly explosive. The gas produced by its explosion, carbon dioxide, is called choke damp. See also GASES AND ATMOSPHERES, INJURIOUS.

DAMPED WAVES, wireless waves (see HERTZIAN WAVES) which occur in groups and whose amplitudes gradually decrease. Such waves are unsuitable for telephonic purposes, since the rapidly recurring groups of waves give rise to a tone whose pitch is determined by the number of groups per second. They may, however, be used for wireless telegraphic communication, e.g., in the SPARK TRANSMITTER.

DAMROSCH, LEOPOLD (1832-85), German musician, was born in Posen, Oct. 22, 1832. After receiving his medical diploma from Berlin University he decided, against his parents' wishes, to become a musician. He toured first as a concert violinist, and in 1859 became conductor of the Breslau Philharmonic Orchestra. In 1871 he came to the United States as conductor of the Arion Society, two years later founding the New York Oratorio Society, and in 1878 the New York Symphony Society. His compositions include seven cantatas and three violin concertos, but he gained fame as a music pioneer who,

DAMROSCH—DAMS

as conductor of Wagnerian operas at the Metropolitan Opera, New York, and as an indefatigable worker in other musical fields, contributed materially to the dissemination of musical culture in the United States. He died at New York, Feb. 15, 1885.

DAMROSCH, WALTER (1862-), American music conductor, was born at Breslau (Prussia), Jan.

His own operas include *The Scarlet Letter*, *Cyrano*, and the light opera *The Dove of Peace*. In 1928 he was appointed music counsel of the National Broadcasting Co.

DAMS, artificial barriers across a watercourse, constructed for various purposes, to impound water to use in regulation of a stream for navigation or flood

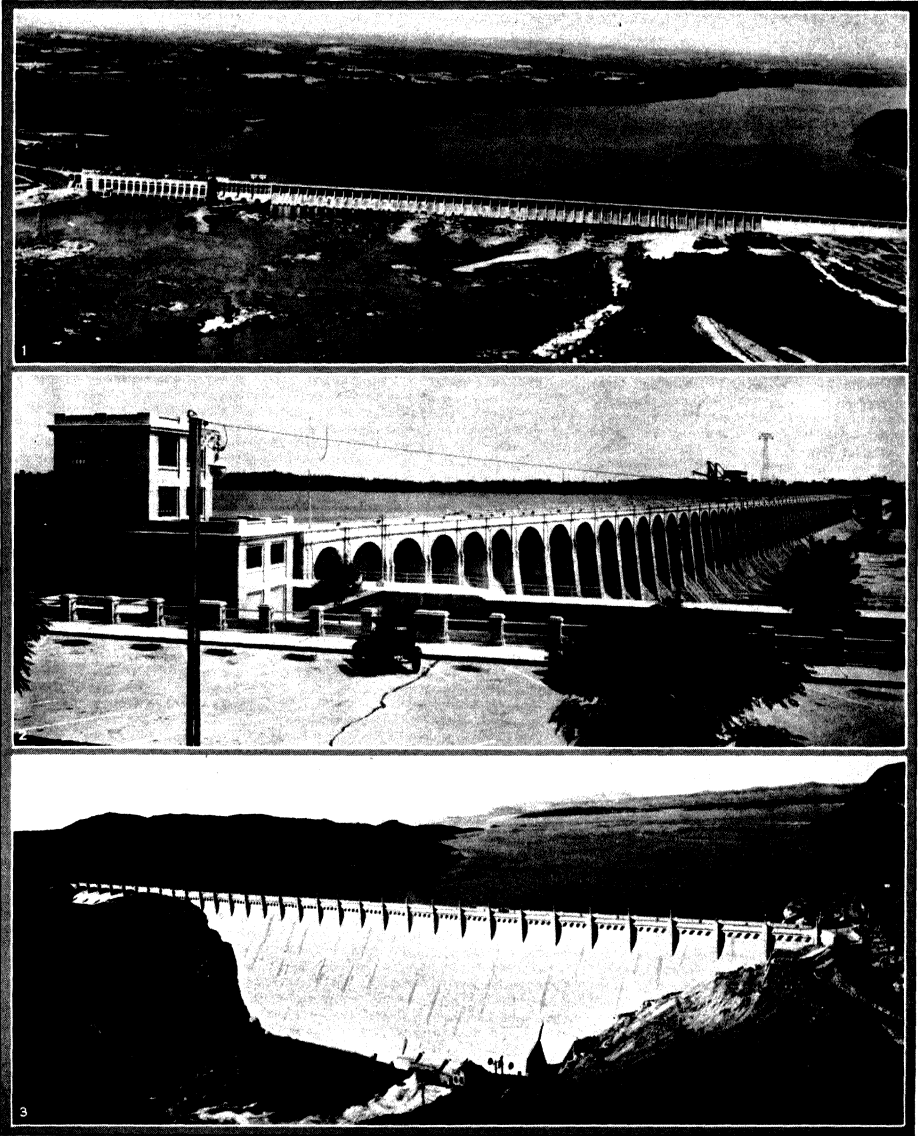
NOTABLE DAMS

Name	Location	Type of Construction	Height (Max.) Ft.	Length (Crest) Ft.	Year Com- pleted
Arrowrock	Idaho	Arch-gravity, rubble con- crete			
			350	1,100	1916
Ashokan (Olive Bridge)	New York	Gravity, masonry	252	1,000	1913
Ashu	India	Earth	58	12,700	1878
Aswan	Egypt	Gravity, concrete, masonry	147	6,200	1912
Calaveras	California	Earthfill (hydraulic)	240	1,260	1918
Camarava	Spain	Arch-gravity, concrete	333	460	1920
Castlewood	Colorado	Rockfill	92	600	1890
Cobble Mountain	Massachusetts	Earthfill (hydraulic)	245	700	1930
Conowingo	Maryland	Gravity, concrete	105	4,700	1928
Coolidge	Arizona	Multiple dome, concrete	251	700	1928
Croton (new)	New York	Gravity, masonry	297	1,168	1906
Diablo	Washington	Arch, concrete	426	1,200	1931
Elephant Butte	New Mexico	Gravity, rubble concrete	305	1,310	1916
Exchequer	California	Arch-gravity, concrete	333	950	1926
Gatun	Panama, Canal Zone	Earthfill	105	7,800	1913
Goose Creek	Idaho	Earthfill	145	1,050	1913
Hoover	Nevada, Arizona	Arch-gravity, concrete	730	1,100	1938
Kensico	New York	Gravity, Cyclopean ma- sonry	307	1,843	1917
Keokuk	Iowa-Illinois	Gravity (overflow), con- crete	53	4,300	1913
Lake Hodges	California	Multiple arch, concrete	136	750	1919
Lake Pleasant	Arizona	Multiple arch, concrete	256	1,850	1926
La Prele	Wyoming	Hollow, concrete	135	360	1909
Morena	California	Rockfill	150	520	1909
Nexaca No 2	Mexico	Earthfill (hydraulic)	190	1,220	1911
O'Shaughnessy (Hetch-Hetchy)	California	Gravity, Cyclopean con- crete	344	600	1922
Owyhee	Oregon	Arch-gravity, concrete	405-530	800	1932
Pacoima	California	Arch, concrete	375	550	1927
Pathfinder	Wyoming	Arch, concrete	218	432	1910
Roosevelt	Arizona	Gravity, concrete, masonry	280	680	1911
Salt Springs	California	Rockfill	328	1,300	1931
Saluda	South Carolina	Earthfill (semi-hydraulic)	212	7,838	1930
San Antonio	Spain	Gravity, concrete	300	670	1916
Schraech	Switzerland	Gravity, concrete	362		
Sennar	Egypt	Gravity, concrete	130	9,915	1926
Shoshone	Wyoming	Arch, concrete	328	200	1910
Tieton	Washington	Earth and Rockfill	232	900	1925
Wachusett	Massachusetts	Gravity, masonry	228	1,476	1906
Wilson	Alabama	Gravity (overflow), con- crete	132	4,111	1926

30, 1862. From earliest childhood he was devoted to music, which he studied in Germany. When his father, LEOPOLD DAMROSCH, began his German opera in New York, he acted as assistant conductor. He succeeded his father as conductor of the Oratorio and Symphony societies. He organized in 1894 the Damrosch Opera Company, and toured the United States for five years. In 1900 he became conductor of German opera at the Metropolitan Opera, New York.

control, for power use, public water supply or irrigation. They are constructed of masonry, either solid or hollow, timber, steel, earth, rock fill and various combinations of these materials. Overflow dams are those designed for the flow of water over the "crest." Movable dams are those provided with features such as "needles," "curtains," "wickets," "shutters," "gates," or "drums," to regulate the flow of water. Dams must be designed to prevent struc-

DAMS



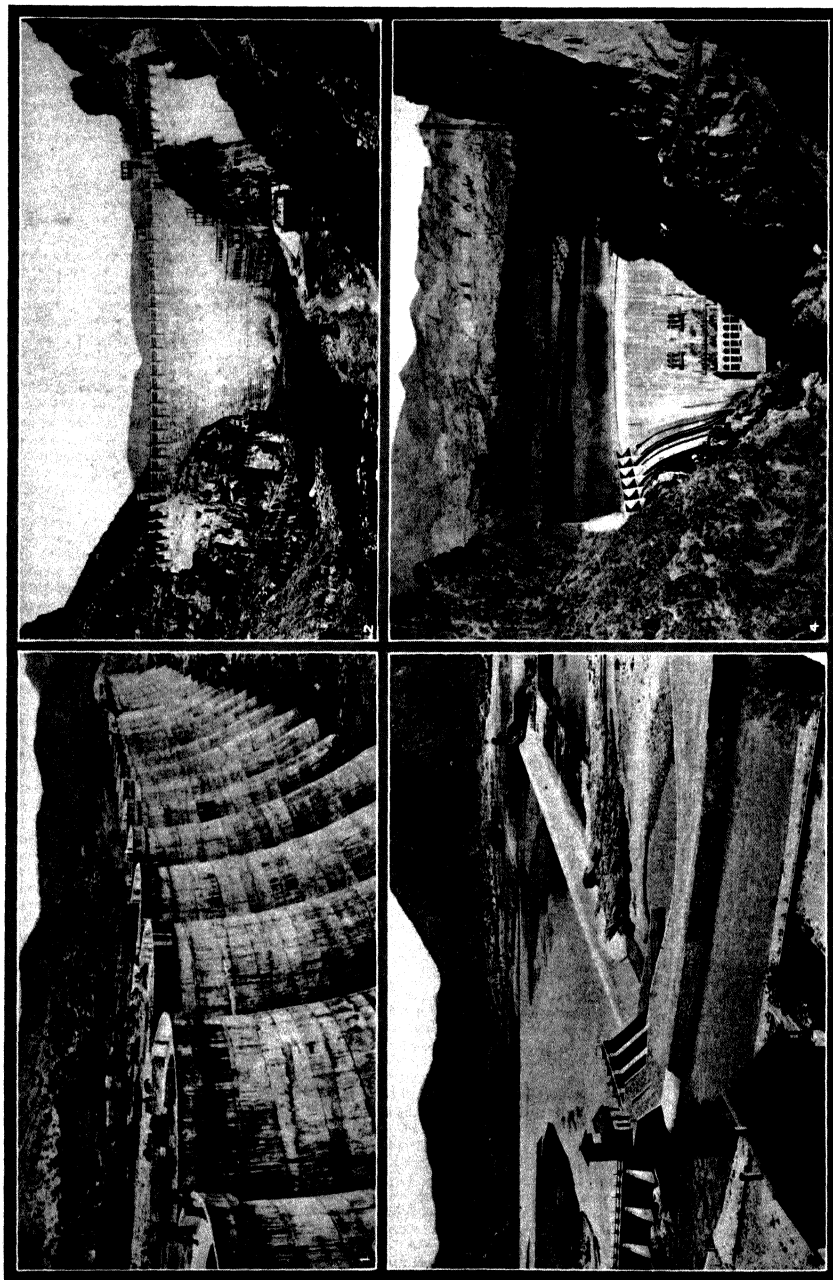
1. COURTESY OF PHILADELPHIA ELECTRIC CO.; 2. UNITED STATES ENGINEERS OFFICE; 3. BUREAU OF RECLAMATION

THREE OF AMERICA'S NOTABLE DAMS

1. Conowingo (Md.) private power dam, Susquehanna River; completed 1928; cost, \$52,000,000; height, 105 ft.
2. Wilson government power dam (Muscle Shoals), Ten-

nessee River; completed 1926; cost, \$51,000,000; height, 142 ft. 3. Elephant Butte government irrigation dam, Rio Grande River project; completed 1916; height, 306 ft.

DAMS



COURTESY U.S. BUREAU OF RECLAMATION

IRRIGATION DAMS ON THE SALT RIVER PROJECT, ARIZONA

1. Cave Creek Dam, multiple arch reinforced concrete construction, completed in 1923.
2. Roosevelt Dam, gravity overflow concrete masonry construction, completed in 1911.
3. Granite Reef Dam, gravity overflow concrete type, completed in 1908.
4. Horse Mesa Dam of arch concrete construction, completed in 1927.

tural failure; overturning; harmful passage of water over, through or under them; erosion; damage due to waves or ice; harmful settlement; hydrostatic uplift; and, in case of earth dams, burrowing animals.

Auxiliary structures include spillways or sluiceways

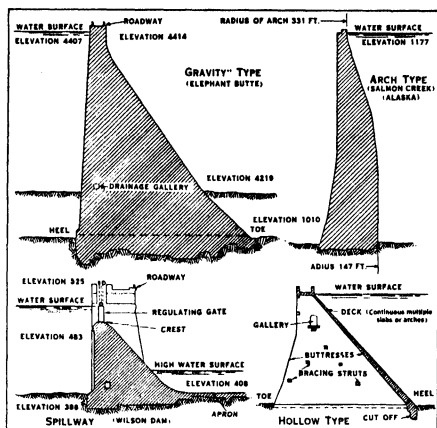
North American species are rather small. Only a few are strikingly colored. The tropical species are large and brilliant. They frequent the margins of ponds and streams, fitting about the foliage rather than flying swiftly like the horizontal-winged dragonflies. The nymphs live in water where they feed on small aquatic animals.

DANA, CHARLES ANDERSON (1819-97), American editor and publicist, was born at Hinsdale, N.H., Aug. 8, 1819. He prepared himself for matriculation at Harvard, where he studied until 1841, and in that year joined the Brook Farm Community at Roxbury, Mass. He was reporter and later editor of the *New York Tribune* during 1847-61. In the early part of the Civil War he was a military observer for the Government, and the last 2 years of the war he served as Assistant Secretary of War. While editor of the *New York Sun* during 1868-97, Dana laid stress on the "human interest" of news-stories, and his vigorous methods left a deep impress on American journalism. He died at Glen Cove, Long Island, N.Y., Oct. 17, 1897. See also *NEWSPAPER*.

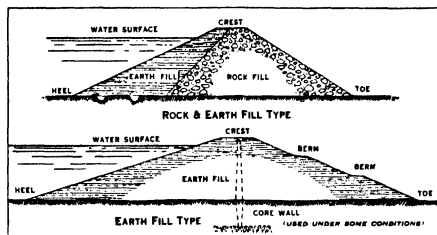
DANA, JAMES DWIGHT (1813-95), American geologist, born at Utica, N.Y., Feb. 12, 1813. He attended Yale College, quitting his studies before graduation to become an instructor in the Navy. Dana joined Wilkes' exploring expedition to the Pacific in 1838. In 1842 he returned with a vast geologic collection. In 1846 he became editor of the *American Journal of Science* and in 1849 professor of natural history at Yale. Among the more important of his extensive writings upon geology were *System of Mineralogy*, 1837; *Manual of Geology*, 1862; and *Text-book of Geology*, 1864. He died at New Haven, Conn., Apr. 13, 1895.

DANA, RICHARD HENRY (1815-82), American lawyer and writer, was born in Cambridge, Mass., Aug. 1, 1815. He entered Harvard University in 1832, but eye trouble necessitated rest, and in 1834 he took a two-year voyage to California as a sailor on the brig *Pilgrim*. He returned and completed his college course. In 1840 he was admitted to the bar. In the same year he published his famous story of his voyage, *Two Years Before the Mast*. In 1841 he published a manual for sailors, *The Seaman's Friend*. He was Federal Attorney for Massachusetts, 1861-66, and represented the United States in the Jefferson Davis trial, 1867-68. He died in Rome, Italy, Jan. 6, 1882.

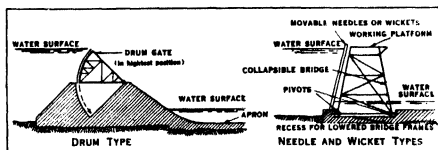
DANAE, in Greek mythology, daughter of Acrisius, King of Argos, who was the great-grandson of Danaus. An oracle had prophesied that Acrisius would be killed by the son of his daughter. He therefore imprisoned Danaë in a bronze tower. There



TYPES OF MASONRY DAMS, SHOWING CHARACTERISTIC FEATURES OF THE DAMS AND OF A SPILLWAY



CROSS SECTIONS OF TYPICAL EARTH AND ROCK FILL DAMS



MOVABLE DAMS FOR REGULATING THE FLOW OF WATER

for passing excess or waste water; headworks for power, irrigation, water supply, or navigation purposes; and fish ladders. See also CANALS and CANALIZATION; RIVER IMPROVEMENT; FLOOD CONTROL. For individual dams, see under name of dam.

F. R. H.

BIBLIOGRAPHY.—E. Wegman, *Design and Construction of Dams*, 1927; W. P. Creager, *Engineering for Masonry Dams*, 1917.

DAMSEL-FLY, the popular name for dragon-flies whose wings fold above the abdomen when in repose.



COURTESY M. OF FINE ARTS, BOSTON

CARPENTER PREPARING THE CHEST FOR DANAE AND PERSEUS

From a 5th century B.C. hydria

ZEUS came to her in a shower of gold and her son PERSEUS was born. Her father threw them both into the sea in a chest. They were rescued, however, by a fisherman on the island of Seriphos. When Perseus was grown they returned to Argos, where Perseus accidentally killed Acrisius at Larissa.

DANAÏDES, in Greek mythology, the 50 daughters of Danaus who married the 50 sons of their uncle Aegyptus. An oracle had foretold that Danaus would be slain by a son-in-law, so he commanded his daughters to kill their husbands on their wedding night. All but one obeyed. For their crime they had to fill sieves with water endlessly in Hades.

DANBURY, a city in southwestern Connecticut, county seat of Fairfield Co., situated on the Still River, 65 mi. northeast of New York City, served by bus lines and the New Haven Railroad. There is a municipal airport. The manufacture of felt hats is the principal industry. Lighting fixtures, paper boxes, rubber floor covering, silver plate ware, thread and novelties are also produced. In 1929 the total manufactures were approximately \$37,000,000; the retail trade amounted to \$18,104,223. Danbury was founded in 1684, was chartered as a borough in 1822, and became a city in 1889. Gen. David Wooster of the American Revolution fell in action near the city. James Montgomery Bailey, founder of the Danbury *News*, wrote several books about the city. In the famous Danbury Hatters' Case, 1915, the manufacturers sued the Danbury hatters for the violation of the Sherman Act, and the United States Supreme Court upheld the plaintiff. Pop. 1920, 18,943; 1930, 22,261.

DANBURY HATTERS' CASE, an industrial dispute, notable in the history of organized labor in the United States, involving the legality of the boycott. The Hatters' Union in 1902, failing to induce D. E. Loewe and Company of Danbury, Conn., to employ only union labor, instituted a nation-wide boycott against the products of that concern. Suit was brought by the company, alleging that the boycott was a combination in restraint of trade (see *SHERMAN ANTITRUST ACT*). The case, prolonged for 14 years and reaching the Supreme Court three times, ended with an award of triple damages, \$240,000, to the plaintiff. The company attached bank accounts and began foreclosure proceedings against 140 homes belonging to union men as security for payment of damages.

DANCE, SUN. See *SUN DANCE*.

DANCE, THE. Whether regarded as an instinctive social practice or as a conscious art form, the dance may be defined as the expression of emotion through the medium of bodily movement. Since movement is the most elementary means for the expression of emotional concepts and since its instrument is inseparable from man even in his most primitive state, the dance is logically conceded to be the oldest of the arts. Its essentials, which have remained unchanged in spite of the succession of changing forms surrounding them throughout the centuries,

can best be observed by a brief consideration of their natural origins in primitive society.

To the savage, everything in daily life transcended his reason, from such natural phenomena as the rising of the sun, the fertility of the soil, the rainfall, to such personal experiences as birth, sex and death; and his reaction to them could be externalized only by some means which did not rest upon intellectual understanding. Sometimes he danced merely as a vent for his emotional excitement; sometimes actually in the effort to assist the processes of nature, to appease hostile deities or to invoke benign influences; sometimes for the purpose of conveying to others his inward feelings. His dances were frequently mimetic, but not always so; they were invariably clear in their intention, however, to the onlookers, who often fell so completely into the spirit of the dancer as to join in the dance or at least to assist by making rhythmic noises to point certain movements of the dancer. The development of ritual, religious and otherwise, can be clearly seen to have its origin in these practices. At all important moments in the life of the individual and of the group in primitive society, one finds dancing to have been the infallible rule. In addition to those dances which were fundamentally of religious nature, there were also many recreational and occupational dances.



FROM MAXIMILIAN VON WIED-NEUWIED'S TRAVELS

PRIMITIVE DANCER OF THE
HIDATSA TRIBE
From a drawing by Karl Bodmer



FROM MAXIMILIAN VON WIED-NEUWIED'S ATLAS

DANCE OF THE MANDAN INDIANS
After a drawing by Karl Bodmer

As civilization has advanced and intellectual activity has reduced the element of mystery in daily living, the necessity for expressing concepts which exceed the intellectual capabilities of the individual has been correspondingly reduced. The arts, nevertheless, rest

upon the same basis. The artist dancer still expresses in his dance his glimpse of a transcendent truth which he cannot externalize through wholly intellectual means.

The process by which this glimpse is conveyed to the onlooker is kinesthetic, i.e., the dancer's emotional experience or extra-intellectual concept commonly called "inspiration," objectifies itself in certain muscular reactions which awaken in the sympathetic spectator the memory of similar muscular reactions which he has experienced or can conceive of himself as experiencing, and these in turn arouse in him an extra-intellectual appreciation of the emotional processes which underlie them. The farther the dancer's movements are removed from miming, which is essentially a cruder form of the same process, the greater the demand upon the kinesthetic response of the onlooker; also, as in the other arts, the farther the artist departs from imitative naturalism, the more he must rely upon the arrangement of the elements of his composition in a form which shall function esthetically.

Throughout the history of the dance as an art, its leaders have all been actuated by the same desire to make it capable of more and more vivid as well as profound expression. The periods when it has found itself to be least respected and least worthy of respect have been those in which it has lapsed from this line of progression and degenerated into either mere sex stimulation or physical virtuosity. This is equally true of the social and folk dance which, when it has persisted after its general usefulness to the group has declined, has turned on the one hand toward competitive gymnastics and on the other toward the orgy. Both these extremes, which are here referred to as decadent, are also to be found, however, to be normal to most primitive societies.

In the choric dancing of the classic Greek theater one finds the dance for the first time a pure art form of a high order, and that, indeed, of an extraordinarily high order. Until the rise of the modern dance within the present century, it may be said to have



DANCING MAENADS

From the exterior of a red-figured kylix,
5th century B.C.

been the highest development of the dance form in western culture. "The ancient dance," says Gilbert Murray in *Euripides and His Age*, "... was religious; it was a form of prayer. It consisted in the use of the whole body, every limb and every muscle, to express somehow that overflow of emotion for which a man has no words." It is upon this principle that the modern dance was posited by Isadora

Duncan and has been built by those who have come after her.

Though in the Roman theater the dance lost much if not all of its grandeur, it acquired a new skill on the part of the individual dancer in the pantomimes, and this carried over for a long period after the decline of the Roman civilization, in the *jongleurs*, in the early Italian comedies and subsequently in the *Commedia dell'Arte*. The more solemn and religious element of the Greek dance was absorbed by the church and put forth anew in processions and mysteries.

Toward the end of the 15th century a crude form of dancing established new roots in the courts of Italy and almost immediately afterwards of France. It had little trace, however, either of the religious or expressional qualities of the ancient dance; it was in the main an elaborate procession combined with interludes of singing, declamation and feats of acrobacy in celebration of some event in the life of the court. Because its only claim to design lay in the patterns traced along the floor by the marchers, it has come to be known as the ambulatory ballet. The first ballet on record took place at Tortona in Italy in 1489, and nearly a hundred years passed before the next step was taken toward making the dance express something. This next step was the utilization of a connected plot of sorts, first introduced by Baltasarini, ballet master to the court of France, in his *Ballet Comique de la Roynie*. This forward step, however, had little or no relation to the dance itself although it did advance its progress toward the goal.

With the growing popularity of dancing in the court, it became necessary to add to the repertoire of stately and processional *danses hautes*, and by way of contrast folk dances were transplanted from the countryside, though with considerable adaptation. Though there is no historical verification, it seems likely that about this time a great change began to take place in that the ballets no longer devoted themselves exclusively to evolving floor plans, but turned their attention somewhat to the vertical elevation of the individual dancer. It is safe to date the beginning of what has come to be known as the classic dance from the establishment of the *Académie Royale de Danse* by Louis XIV in 1661, with his ballet master, Beauchamp, at its head. To Beauchamp is credited the formulating of the first systematic dance technique including the fundamental "five positions."

The chief progress of the classic period lay in the increase of the dancer's range wherever possible. In this period one finds the beginnings of two technical developments of great moment which continued to be improved through roughly two centuries. These were the "turning out" of the hip, which enabled the dancer to move with equal ease in all directions, and the rising upon the points of the toes, which extended the illusion of his ability to defy gravity. The dance, thus absorbed in the much needed increase of the dancer's physical range, naturally paid less attention to the development of its powers of funda-

mental expression, and when Jean Georges Noverre (b. 1727) came upon the scene about the middle of the 18th century, he initiated a radical reform in this direction. Noverre objected seriously to the emphasis upon virtuosity, and in his theory of the *ballet d'action*, all extraneous bits of exhibitionism were excluded, and all the dancing was centered in the one purpose of carrying out the underlying idea of the work being performed. This was the most wholesome reform that had come upon the dance since the beginning of the ballet, and it served to change the whole course of the dance that followed. Eventually, however, as progress in other lines of human activity outpaced that in the dance and no new leader appeared, even Noverre's notable contribution to the art became outmoded, and the dance fell into a steady decline which reached its nadir in the last years of the 19th century. The ballets had come to consist of certain stereotyped steps in set combinations, the dancers wearing conventional costumes, and the plot of the piece being carried forward by intervals of miming performed by a system of conventional gestures almost exclusively of the hands.

It was at this point that ISADORA DUNCAN arose with her revolutionary theory of the dance, which far exceeded Noverre's both in its radicalness and its effectiveness. She discarded the entire paraphernalia of the ballet—its technique, costumes, music and libretto. She utilized only natural movements of the body and these were not dictated by any arbitrary formulae but grew out of her emotional conviction. Instead of the tarlatan skirts and satin slippers of the ballerina, she wore robes of a Greek type and had bare feet.

For years before her advent upon the scene, FRANÇOIS A. N. C. DELSARTE (1811-71) had been waging a war in the theater against the same sort of artifice which held the dance in its grip, and it is undoubtedly to his influence that Isadora owed something of her inspiration, though no direct link has been traced between them. To Delsarte a gesture without a meaning was unthinkable, and his work lay in investigating the reactions of the body to various physical and emotional stimuli. In this investigation he broke the soil for the modern dance, although his method itself has long since been discarded even by the theater for which it was devised.

Isadora is sometimes mistakenly thought to have attempted a restoration of the Greek dance, but this she denied specifically. Although the fundamental concept of her dance was also the fundamental concept of the Greek dance, she made no effort toward archeological restoration. If her physical movements were the objectification of her emotion, this in turn was stimulated by music ranging from the preludes of Chopin to the symphonies of Beethoven. It was her ideal that dancing should not be confined to professionals upon the stage, but that laymen as well should be encouraged to dance for their own delight.

Stimulated by her reforms and himself long restless under the barrenness of the classic ballet, MICHEL

FOKINE introduced a revolutionary reform into the Imperial Russian Ballet of which he was a member. He enunciated the principle that stereotyped forms should give place to the expression of the underlying idea; and to this end he abolished the almost inevitable use of the toe-slipper, the ballet-skirt, the "turned-out" hip, the meaningless mimetic system, and all the time-honored devices of the old ballet, substituting for them, as regards both choreography and mounting, the requirements of the period and the character of the work to be produced. He also paid considerably more attention than had ever been paid before to group dancing. This period in which Isadora and Fokine were the outstanding figures, extending roughly from the beginning of the century to the World War, has sometimes been called the "Romantic Revolution."

After the war a new era opened, tending in the same direction but by a divergent road. Serge Diaghileff, who had introduced the ballets of Fokine to the world outside Russia, carried the reform movement to a logical issue and injected into the dance an element of "modernism" corresponding to the tendencies in contemporary music and painting. He discarded not only every vestige of the old ballet except its method of technical training, but also the complete romantic theory with which Fokine had fought the aridity of degenerate classicism. Diaghileff's labors were cut off by his death in 1929 before they had achieved their final goal.

In a similar movement of protest against romanticism, this time the romanticism of Isadora Duncan, a new school of dancers sprang up in Germany, basing their technique on advanced methods of physical culture and their esthetic doctrine on the simple expressionistic credo of the modernists in the other arts. Unlike Diaghileff, who worked from the standpoint of the desired result back to the means for producing it, the Germans worked from the basis of inner conviction and feeling, allowing these to externalize themselves as they would. The dance they thus created was termed the "absolute dance," since it depended for its creation neither upon music, story, nor any other external inspiration. It was to a large extent a discarding of all that had gone before and a return to the original sources of the primitive dance.

Mary Wigman has been the outstanding leader of the German movement, although her teacher, Rudolf von Laban, has supplied much of its theory. One of her most notable reforms was her new attitude toward music. During the most "absolute" period of her career, when she was seeking to find the substance of the dance as an independent art, she dispensed with music altogether. Later she came to see that it could be utilized in simple forms as an accessory with advantage. She therefore began the use of piano, primitive flutes and percussion instruments for accompaniment, and arranged for the composition of her musical settings to take place simultaneously with her composition of the dances. Lay dancing has also been a cardinal point in her theory.

In America, which never produced a classic dancer of the first order, the modern movement has created a wide following and some of the most distinguished dancers, including Martha Graham and Doris Humphrey. Nowhere except in Germany is the modern dance movement so active and so vital.

Though the modern dance cannot be called a method, since it varies with the individuals practicing it, there are certain qualities common to all its manifestations, and it is these rather than any formal technical method that characterize it. In the first place, it works on the basis that movement is the substance of the dance instead of attitudes which are essentially static. It relies on the kinesthetic principle that emotion can be conveyed from the mind of the dancer to that of the spectator by means of physical movement. It recognizes no set forms, but allows the form in each case to grow out of the material. It insists above all that the dance must express something. It upholds Isadora's canon that lay dancing should be encouraged, and in this it has succeeded to a large extent, especially in Germany. See also BALLET.

J. MA.

BIBLIOGRAPHY.—G. Vuillier, *A History of Dancing*, 1898; J. E. Crawford Flitch, *Modern Dancing and Dancers*, 1912; Troy and Margaret W. Kinney, *The Dance*, 1914; André Levinson, *La danse au théâtre, esthétique et actualité mêlées*, 1924; Isadora Duncan, *The Art of the Dance*, 1928.

DANCE IN INDIA, THE. The dance has been a cultivated art in India from remote ages, largely under royal patronage. The Indian classification distinguishes *nṛtta* (rhythmic dancing without narrative theme, and including "folk-dancing"), *nṛtya* (dramatic dancing, with narrative or descriptive theme), and *nāṭya* (the same used in drama, and equivalent to "acting"). *Lāsya* is a feminine and graceful, *tāṇḍava* a vigorous masculine style. The English word "nautch" is a derivation from the vernacular root *nāc* to dance, and Sanskrit *nat*; this is usually the form defined above as *nṛtya*, which is performed as part of the office in a temple (when the danseuse is designated a *devadāsī*, "bayadere"), or before a king, or at marriages, or other festive, auspicious or solemn occasions, or as an entertainment given by a private patron. It is a purely professional art, but was at one time also an aristocratic accomplishment. Nothing like the mixed ball-room dancing of Europe is known in India, where the European dance is looked upon as improper.

The nautch is accompanied by music (drums and *sārāṅgi* in the north, drums and *tambura* in the south) and the danseuse either sings her own libretto or has a chorus. The distinctive feature of the style is the use of the movements of the head, eyes, brows, and especially the hands to express definite meanings, which are presented in rhythmic sequence like the words of a poem; these gestures, *abhinaya*, are partly pantomimic, partly more abstract, and so far conventional as only to be intelligible to an educated spectator. A treatise on dancing consists mainly of a dictionary of gesture; in a well-known work the technique is briefly summarized as follows: "The song

should be sustained in the throat; its meaning must be shown by the hands; the mood must be shown by the glances; rhythm is marked by the feet. For wherever the hand moves, there the glances follow; where the glances, there the mind follows; where the mind goes, the mood follows; where the mood goes, there is the flavor (*rasa*)."

The feet are moved only subordinatedly, marking the rhythm, and such a dance may even be performed sitting. The danseuse is fully and elaborately clothed; numerous small bells worn on the ankles are the most distinctive feature of the costume. The performance is always decorous; the character of the art in no way reflects the fact that danseuses are often courtesans. The education of the danseuse begins with initiation at five; after instruction by a retired dancing mistress from seven to twelve, the young artiste is ready to appear.

There are numerous legends and representations of dancing deities. The most important of these is connected with Śiva, who is represented as Natarāja, Lord of the Dance, and received worship in this form. Śiva's dance is a vision of the cosmic process, representing an energy continuously manifested in creation, perpetuation and destruction, embodiment and release; a legend is told of its origin, but it is only rightly apprehended when realised as taking place within the worshipper's own consciousness. Gaṇeśa, the elephant-headed deity, is often represented as dancing. Krishna's dance of triumph over the hydra Kālīya, and his circular dances with the milkmaids in Brindāban are often represented in painting and sculpture.

The Indian dance tradition combined with local features has given rise to great and still surviving styles of dramatic dancing in farther India and Indonesia; the Cambodian and Javanese schools especially exhibiting a wonderful virtuosity, power and grace. The *pas seul* of the actor at his first entrance interpreting his character, is frequently seen. The Javanese sacred dance of nine *bedoyo* is particularly beautiful. There are also masked dances in Java and Bali. See also DANCE.

A. K. C.

BIBLIOGRAPHY.—G. Groslier, *Danseuses cambodgiennes*, 1913; A. K. Coomaraswamy and G. K. Duggirala, *The Mirror of Gesture*, 1917 (translation of the *Abhinaya-darpanam*); Th. B. van Leliveld, *La danse dans le théâtre javanais*, 1931; S. Marchal, *Danses cambodgiennes*, 1926; A. Meerwarth, "Les Kathākalis du Malabar," *Journal Asiatique*, 1926.

DANCER, one who professionally performs, interprets or enacts thought, emotion or narrative by rhythmic physical combinations of gestures, attitudes, poses, movements or sequences of steps to convey an underlying idea to the spectators. There are many kinds of dancers, including the tap dancer, who performs tap and step routines, buck and wing, clogs, jigs, reels and eccentric dances; the musical comedy dancer, performing a particularly light, dainty and expressive type of dance peculiar to musical comedy production; the acrobatic dancer, who performs routines of acrobatic tricks, contortion movements or tumbling tricks; the ballet dancer, whose art includes classical toe, jazz and eccentric toe, interpretive, esthetic, character, national folk dances and pantomime;

exhibition ballroom dancers who, in pairs or teams, perform spectacular and exaggerated arrangements of ordinary ballroom dances; adagio dancers, who are members of highly specialized duets or trios which perform difficult combinations of ballet and acrobatic dancing.

Dancing is often a lucrative occupation, offering many and varied opportunities of engagement according to the type of dance and the degree of training and technical perfection. A wide range of employment is open to dancers in revues, musical comedies, light operas, operas, vaudeville, motion picture stage presentations, motion pictures and talking pictures, clubs, banquets and many other branches of the entertainment world. See also ACTOR. N. W.

DANDELION (*Taraxacum officinale*), a common perennial plant of the sunflower family. Originally a native of the Old World, it has by naturalization become immensely abundant as a weed in most tem-



COURTESY IOWA GEOL. SURV.

COMMON DANDELION

Achenes, single flower, head and leaf, and receptacle and seed with pappus

perate regions. It is a stemless plant with a long stout root and possessing a bitter milky juice. The jaggedly toothed leaves form a rosette from which rises a hollow flower-stalk ending in a head of brilliant yellow flowers. The grayish seed-vessels, bearing slender feathery-tufted beaks, are readily blown about by the wind. In spring the fresh leaves are used as a potherb and for salads. The root, sometimes employed as an adulterant for coffee, possesses medicinal properties. The similar red-seeded dandelion (*T. levigatum*) with dark red seed-vessels, is also widespread as a weed.

DANEGELD, the name given to an English tax levied for the first time in 991 by ÆTHELRED THE UNREADY, the proceeds of which were applied as tribute to the Danish invaders. It was originally imposed by decree of the witan and was continued even under Danish rule, 1017-42, after the original purpose of the tax had been forgotten. In 1051 Edward the Confessor temporarily freed the English from this burdensome tax. William the Conqueror, however,

seized upon the Danegeld as a useful expedient in taxation and made the Domesday survey partly with the idea of determining the material basis for levying it. The tax now came to be imposed annually and was continued well into the 12th century and under different names thereafter. The Danegeld in 1084 for instance was an imposition of six shillings for every hide of land or for every individual holding.

DANELAGH or **DANELAW**, the name of the territory in east and northeast England invaded and overrun in the 8th, 9th and 10th centuries by the Northmen. Roughly, this area occupied by the Danes and other northern invaders extended from the Thames to the Tweed. It was surrendered to Guthrum, king of the Danes, by ALFRED THE GREAT in the treaty of Wedmore in the late 9th century. The territories embraced eastern Mercia, Northumbria from the Tees to the Humber River, East Anglia, and the adjacent shires west and south. By 955 all of the Danelagh had submitted to English rule.

D'ANGHIERA. See ANGHIERA, PIETRO MARTIRE D'.

DANIEL, SAMUEL (1562-1619), English poet, was born near Taunton, Somersetshire, in 1562. He spent some time at Oxford, then traveled in Italy and was tutor to William Herbert. The series of exquisite sonnets addressed to Delia, 1592, is his most famous work. For a short period Daniel was Poet Laureate, resigning in favor of BEN JONSON. Appointed master of the Queen's Revels in 1602, he wrote a number of masques and tragi-comedies. His verse possesses grace, distinction and often great beauty. Among his writings are *The Complaynt of Rosamond*, a poem of outstanding merit; *Hymen's Triumph*, his best known drama; and a history of England. He died at Beckington, Wiltshire, Oct. 14, 1619.

DANIEL, BOOK OF, the fourth of the major prophetic books of the Old Testament, derives its name from the central figure in its narratives and visions. Because of the popular interest in Daniel's miraculous stories and the apparent Messianic character of the book, it is widely received as historical; yet its authenticity has long been questioned, on both linguistic and historical grounds. The author, who is thought by many scholars to have lived about 167 B.C., with which period he shows familiarity, is very vague in his references to the days in which Daniel is said to have lived, and is not always accurate. He erroneously states that Nebuchadnezzar was the father of Belshazzar, and that the latter was the last Babylonian king. He also avers that Darius and not Cyrus was the successor of Nabonidus, although history knows nothing of a Darius the Mede preceding Cyrus. The book was evidently written to encourage the Jews by an outstanding example of fidelity, and may have had some basis in the life of a historic Daniel. The Apocrypha adds to the Daniel narratives the stories of Bel and the Dragon, Susanna and the Song of the Three Children.

DANIEL DERONDA, a novel by GEORGE ELIOT, published 1876, depicting various aspects of the

Jewish character. Daniel Deronda, the hero of this work, is brought up by Sir Hugh Mallinger in complete ignorance of his descent. The story is concerned with Daniel's growing appreciation of the fine qualities of certain Jews whom he meets after he has saved from suicide the young Jewess, Mirah Lapidoth; with his extending sympathy with their struggles for justice; and at last with his discovery, made through his mother, that he is himself a Jew. An outstanding minor character is Daniel's friend, the noble Mordecai, an ardent Zionist.

DANIELL, JOHN FREDERIC (1790-1845), English physicist, was born at London, Mar. 12, 1790. He became a fellow of the Royal Society in 1813 and professor of chemistry at King's College, London, in 1831. He invented a water barometer, a dew-point hygrometer, a recording pyrometer and the Daniell Cell, an electrical battery designed to furnish continuous current at low voltage (see CELL, VOLTAIC). He died at London, Mar. 13, 1845.

DANIEL CELL. See CELL, VOLTAIC OR PRIMARY.

DANIELS, JOSEPHUS (1862-), editor and public official, was born at Washington, D.C., May 18, 1862. After studies at Wilson Institute he was admitted to the bar in 1885. During 1893-95 he was chief clerk of the Department of the Interior, which he left to assume the editorship of the Raleigh, N.C., *News and Observer*. He was publicity-director of the Wilson forces in 1912, and Secretary of the Navy during Wilson's two terms, 1913-21. While a member of the cabinet, he introduced many benefits for the navy personnel, including the establishment of trade training schools for enlisted men. He returned to his editorial work in 1921. In 1924 he published his *Life of Woodrow Wilson*.

DANISH DRAMA. See SCANDINAVIAN DRAMA.

DANISH WEST INDIES. See VIRGIN ISLANDS OF THE UNITED STATES.

DANNECKER, JOHANN HEINRICH VON (1758-1841), German sculptor, was born Oct. 15, 1758, at Stuttgart. His father was a groom in the stables of the Duke of Wurtemberg, and through the Duke's favor the boy received his start in the field of sculpture. He studied in the workshop of Pajon in Paris in 1783 and in 1785 went to Rome where his study of classic sculpture and his friendship with Canova were important influences on his future work. Dannecker was preeminent as a portrait sculptor. His best known statue is *Ariadne*, 1806, now in the Bethmann Museum, Frankfurt. Dannecker died in Stuttgart, Dec. 8, 1841.

DANNEMORA, a town in Clinton Co., north-eastern New York. It is situated near the Saranac River, about 150 mi. north of Albany. Large deposits of iron ore are found here. Dannemora is the seat of the Clinton State Prison. Pop. 1920, 2,623; 1930, 3,348.

D'ANNUNZIO. See ANNUNZIO, GABRIELE D'.

DANO-NORWEGIAN LANGUAGE, the language of Denmark and Norway forming the East

Norse branch of the Scandinavian group of the GERMANIC stock of INDO-EUROPEAN. Modern Danish, as normally printed and spoken by the educated classes, is a literary language which was superimposed on the living dialects. As a *rigsspråk* it is the vernacular of the whole kingdom of Denmark, and during the political union of that country with Norway (1387-1814) it was also the language of the educated classes in Norway. The Copenhagen chancellery used Danish in its intercourse with Norway after 1450, and the Norwegian chancellery gave up Norwegian in the 16th century. The Reformation and the art of printing made Danish the language of the Church and of the educated, although Norwegian law retained its vernacular until 1600. In the 17th and 18th centuries Norwegian survived only in the form of local dialects. Its reestablishment as a literary language began with the political separation from Denmark in 1814, but the process is not yet completed, so that the competition between the Norwegian *landsmaal* and the Dano-Norwegian *riksmaal* has caused a confused condition of present-day Norwegian. E. Ro.

BIBLIOGRAPHY—V. Dahlerup, *Det danske Sprogs Historie*, 1896; L. Jacobsen, *Studier til det danske Rigssprogs Historie*, 1910; A. Noreen, *Altindische und altnorwegische Grammatik*, 4th ed., 1923; P. Groth, *Norwegian Grammar*, 1924; E. J. Thomas, *Danish Conversation-Grammar*, 1926.

DANO-NORWEGIAN LITERATURE. The earliest works of Scandinavian literature that have come down to us are the poetic tales of gods and heroes which the *skalds* composed and recited, or chanted, in the halls of the chieftains. These poems were handed down by oral tradition and were first collected and put into writing in Iceland, probably about the middle of the 13th century. This collection is now known as the Elder Edda, or the Poetic Edda, to distinguish it from the Younger or Prose Edda of Snorri Sturluson. When or by whom these poems were composed is not known, but it is fairly evident that they originated in Norway at different periods from the 9th century down to the time of Harald the Fair-Haired. Following the poems of the Elder Edda came the Norse and Icelandic family sagas, which reached their highest development in Snorri's *Heimskringla* or *Sagas of the Norwegian Kings*. The language of both the Eddas and the sagas was Old Norse. This became the language of Iceland and has survived there with comparatively few modifications. See ICELANDIC LITERATURE.

Another form of literature which has come down from the early days is the popular ballad. Denmark has been particularly fortunate in preserving a great many of these narrative poems, which often convey interesting information concerning the manners and customs of the times in which they were written. Another valuable work dealing with the early myths and legends and the later authentic history of Denmark is *Gesta Danorum* or *Historia Danica*, written in Latin by the Danish historian, Saxo Grammaticus, who lived in the 13th century.

Danish-Norwegian literature proper may be said to begin with the Reformation, or rather, with the year

1536, when Lutheranism became the official religion of Denmark and Norway. The two countries had then for more than a hundred years formed a dual kingdom which became more and more Danish as time went on. Danish was the language of the officials who represented the king in Norway, and Old Norse, which was seldom written, gradually split up into a number of dialects. Very little literature was produced in either country, and what little there was produced was almost exclusively written in Latin. With the introduction of the Lutheran Reformation came the need for means to instruct the people in the new religion. The Bible was translated into Danish, and hymns and devotional books were written in the same language. At the same time, the Danish language became somewhat corrupted by the introduction of German words and turns of expression. Thus Danish became the official and church language of Norway, as it continued to be until after the separation of Denmark and Norway in 1814.

Such Norwegian writers as arose during this period were compelled to write in Danish, since there was no Norwegian literary language. The foremost of these was the Norwegian, LUDWIG HOLBERG, whose work both in language and content was distinctly Danish. But before Holberg laid the foundations of Danish-Norwegian dramatic literature scholars in both Denmark and Norway had begun to delve into the history and literature of the past. Anders Sørensen Vedel (1542-1616), a Dane, translated Saxo Grammaticus into Danish, collected a hundred old Danish ballads and material for a history of Denmark from the point where Saxo Grammaticus left off. Although he did not write the history, his material was of great value to those who came after him. Another Danish historian of this period was Arild Hvitfeld (1546-1609), who wrote a history of Denmark from the earliest times to the death of Christian III. In Norway, Absalon Pederssøn, who died about 1574, wrote a *Description of Norway*, in which he predicted that Norway would one day again come into its own. Pederssøn kept a diary, which has been preserved, in which he gave an accurate and vivid picture of life in the old Hanseatic town of Bergen.

This period was poor in poetry. The two poets whose works are still read were Thomas Kinge (1634-1703), a Dane, and Petter Dass (1647-1708), a Norwegian. Both were of Scottish descent, and both were clergymen and hymn-writers, although Dass also wrote some ballads and a descriptive poem, *The Trumpet of Nordland*. After Holberg's time poetry received a new impetus from the German poet Klopstock, who resided in Copenhagen for more than 20 years, and whose influence may be traced in the work of Johannes Ewald and others of his time. The theater of this period came under French influence. The Holberg comedies had come to be considered too vulgar for refined audiences. The public demanded musical plays or tragedies in the grand manner of Corneille and Racine (see FRENCH DRAMA).

A much admired example of the latter form of dramatic art was the tragedy, *Zarine*, by Johan Nordal Brun (1745-1816), a Norwegian who afterwards became Bishop of Bergen, Norway. But when Brun wrote another tragedy, *Einer Ta mbeskjælver*, the Danish public did not take to it so kindly. This play dealt with episodes in the history of Norway, and the Danes thought that it glorified Norway at the expense of Denmark. The French type of tragedy was parodied by Johan Herman Wessel (1742-85) in *Love Without Stockings*, written in Alexandrine verse and dealing in tragic style with the troubles of a young journeyman tailor who lacks a pair of white stockings for his wedding day. This play is credited with having eventually driven the imitation French tragedy from the Danish stage. Wessel, like Brun, was a Norwegian, and both were members of the Norwegian Society, a social and literary organization formed by Norwegian students at the University of Copenhagen. This society was instrumental in keeping alive the national spirit among these temporary exiles in a foreign land, and its influence upon the later literary and political history of Norway can scarcely be overestimated.

The early 19th century was a time of great literary activity in Denmark. Again the impetus came from Germany, but this time it was the German Romantics who made their influence felt. The man who is credited with having brought ROMANTICISM to Denmark is Henrik Steffens (1773-1845). Steffens was born in Norway and educated in Denmark and Germany. He was a naturalist and a disciple of Schelling. When he came to Copenhagen in 1802 he lectured on natural philosophy and on literature. Among his hearers was Adam Gottlob Oehlenschläger, who later publicly acknowledged that he had profited by the advice and encouragement of Steffens. Other Danish writers of this period were N. L. F. Grundtvig, B. S. Ingemann, J. L. Heiberg, H. C. Andersen, F. Paludan-Müller, and Søren Kierkegaard. (See also separate articles on these writers.) When the union between Denmark and Norway was dissolved in 1814, the two countries began to go their separate literary ways. Danish was still the literary language of Norway, but a group was soon to arise to fight for a national language. In the meantime Norwegian nationalism found a champion in HENRICK WERGELAND, who opposed the Danish culture but continued to write in Danish. Wergeland's political and literary adversary, J. S. Welhaven, believed that Norway would be best served by building on the foundations of the Danish-Norwegian culture. A bitter feud raged between these two poets.

In the 1840's Asbjørnsen and Moe collected and published many of the old Norwegian legends and fairy tales. In order that the tales should not lose their distinctly Norwegian character they incorporated into the Danish in which they were recorded numerous words and idioms from the Norwegian dialects. About ten years later Ivar Aasen (1813-96) formed a new, standard language based on the dialects of west-

ern Norway, and wrote a grammar and a dictionary of it. This language was called *Landsmaal*, or language of the country, and Aasen proposed that it should be the literary language of Norway. He himself used it in his writings, as did also A. O. Vinje (1818-70), Arne Garborg and some others. Concurrent with this movement for a national language was one for nationalizing the Danish language by incorporating into it more and more words taken from the dialects. Most of Norway's leading writers have preferred this less radical procedure. Some, however, have preferred the *Landsmaal* or the pure dialects of the districts of which they wrote. The *Landsmaal* now occupies an equal official status with Dano-Norwegian.

In addition to those already mentioned, the great names in Norwegian literature of the 19th and 20th centuries are Björnson, Ibsen, Lie, Kielland, Hamsun, Kinck, Undset, Bojer and Duun. These are treated more fully under their respective names. In Denmark the critic, GEORG BRANDES, exerted a marked influence upon the literature of both Denmark and Norway and, indeed, of all Europe. After Brandes in Denmark come such writers as J. P. Jacobsen, Holger Drachmann, Henrik Pontoppidan, Herman Bang, Peter Nansen, Karl Gjellerup, Johannes Jorgensen, Viggo Stuckenborg, Sophus Clausen, Johannes V. Jensen, Martin Andersen Nexø, Jeppe Aakjær, Valdemar Rørdam and Johannes Anker Larsen. The reader is referred to the articles under the names of these writers.

I. A.

BIBLIOGRAPHY.—F. W. Horn, *History of the Literature of the Scandinavian North*, 1884; Axel Orlin, *The Heroic Legends of Denmark*, American-Scandinavian Foundation, New York, H. G. Topsoe-Jensen, *Scandinavian Literature from Brandes to Our Day*, American-Scandinavian Foundation, 1929, Halvdan Koht, *The Old Norse Sagas*, American-Scandinavian Foundation, 1931.

DANTE ALIGHIERI (1265-1321), supreme poet and outstanding national figure of Italy, was born in Florence, probably toward the end of May, in 1265, and died in Ravenna in Sept. 1321. His family were strong Guelfs, and the fact that Dante was born in Florence during the period of Ghibelline ascendancy, from 1260-66, would indicate that his father, Alighiero di Bellincione di Alighiero, who was of honorable Florentine stock, was not of sufficient prominence politically to have been obliged to betake himself and his family into exile with the leaders of the Gueft party. Of Dante's early life little is known, but it is certain that the most important fact of his youth, perhaps of his whole life, was his love for BEATRICE. The story of this is related by Dante in the *Vita Nuova*, a collection of lyric poems bound together by a prose narrative. According to it, Dante first beheld "the glorious lady of his mind" in the spring of 1274, when he was completing his ninth year, and from then on love for Beatrice ruled his soul and exerted a powerful influence over him for the rest of his life. Critics have been divided on the question of Beatrice's identity. Some have seen in her, not a real woman, but

an ideal of womanly beauty and virtue, while others have found her an allegorical figure, a symbol of philosophy. The weight of opinion now falls on the side of those who identify her, as Boccaccio does, with a certain Beatrice Portinari, daughter of a Florentine gentleman, Folco Portinari, who died in 1289. Reality and poetic fancy are so mingled in this delicate story of Dante's first love that it is difficult to affirm with certainty where the one leaves off and the other begins. But we learn from it of the ennobling effect which the sight of Beatrice had upon him and of his grief at her untimely death, which took place in 1290. At the end there is perhaps a hint of the *Divine Comedy* when he says that he will say no more of Beatrice until he can speak of her more worthily, and that if he lives long enough he hopes to say of her "what was never said of any woman." According to his early biographers Dante spent his youth in the pursuit of learning, and he says of himself that by the age of 18 he had "seen the art of saying words in rhyme." Leonardo Bruni, one of his early biographers, represents him as fighting bravely at the Battle of Campaldino in 1289. For the years following the death of Beatrice in 1290, we have few facts to go upon. Dante appears to have sought solace for his grief in the study of philosophy, but neither grief nor study kept him from falling into a riotous manner of living of which he was afterwards deeply ashamed. Probably in 1296 he married Gemma, of the famous Donati family, by whom he had two sons and two daughters. Dante first entered political life in 1295, and from then until his exile in 1302 we find him taking part in the deliberations of various councils of the Florentine Republic and occupying certain public offices, the most important of which was his priorate from June 15 to Aug. 15, 1300. During this year and the one following, Dante was exceedingly active in political affairs. These were troublous times for Florence, for in addition to perils which threatened from without, due in large measure to the aggressive policy of Pope Boniface VIII, the city was also torn by civil strife and faction within its walls. The old party divisions of Gueft and Ghibelline had now given way to those of Black and White Guefts, to the latter of which Dante originally belonged. (See also GUEFT AND Ghibelline.) In May 1300, the two parties came to open warfare, and blood was shed. Towards the close of 1301 Charles of Valois entered Florence, ostensibly for the purpose of trying to bring peace to the divided city. However, he immediately threw all promises of impartiality to the winds, the Blacks were restored to power, and in Jan. 1302 Dante with four others was found guilty of fraud and corrupt practices both in office and out of office, and sentenced to exile. He never returned to Florence. The rest of his life was spent in various parts of Italy, and his wanderings may have taken him as far as Paris. He found refuge for some time with the Della Scala family in Verona, and spent the last four years of life in Ravenna with Guido da Polenta.

With regard to Dante's works in Italian, mention has already been made of the *Vita Nuova*. In the *Convivio*, or *Banquet*, he intended to bring together 14 of his later Canzoni with a prose commentary, but the work was left unfinished after an elaborate introduction and three Canzoni with a commentary on each. The *Canzoniere* is a collection of his lyric poetry which is not included in the *Vita Nuova*. As a lyric poet Dante underwent the influence of Guido Guinicelli and GUIDO CAVALCANTI, but he soon surpassed all his fellow poets of the *dolce stil nuovo* school. Dante's greatest work, indeed the supreme poetic achievement of the middle ages, is the *Divina Commedia*, or DIVINE COMEDY. Divided into three sections which taken together consist of 100 cantos, this work is a vision of the next life, taking the form of a journey through the three realms of the world beyond the grave, the Inferno, Purgatory and Paradise. In a letter of Dante's addressed to Can Grande della Scala, he says of the poem, "The subject of the whole work, then, taken in the literal sense only, is 'the state of souls after death' without qualification, for the whole progress of the work hinges on and about it. Whereas if the work be taken allegorically the subject is 'man, as by good or ill deserts, in the exercise of the freedom of his choice, he becomes liable to rewarding or punishing justice.'" Thus Dante's journey is not the isolated spiritual experience of one man; the poet stands for all mankind, "the type of the whole race of fallen man, called to salvation." Led by VERGIL, who typifies Human Philosophy, based on Reason, Dante goes his arduous way through the nine circles of Hell and then ascends the seven terraces of the Mountain of Purgatory. At the top of it, in the Earthly Paradise, he is met by Beatrice, the symbol of Theology, based on Revelation, who takes him through the nine revolving heavens. The poem ends with Dante's ascent to the tenth heaven, the spaceless, motionless empyrean heaven that is the abode of God, and here he is vouchsafed a vision of the Divine Essence, contemplation of which constitutes the supreme beatitude of the soul. Embracing every phase of medieval lore and learning, and containing much philosophic and scientific material which it is difficult for the average reader to understand, the *Divine Comedy* is at the same time filled with dramatic incidents portrayed with power and insight rarely equalled. Such for example are his encounters with the unfortunate lovers, PAOLO AND FRANCESCA, with Piero della Vigna, the ill-fated chancellor of Frederick II, and with Farinata degli Uberti, the haughty old Ghibelline who seemed to "hold all hell in scorn." One of the more important of Dante's Latin works is the *De Monarchia*, a treatise on the relations of Church and State, in which he undertakes to prove three points: (1) that there must be universal monarchy, or empire, for the well-being of the world; (2) that the right of universal empire belongs to the Roman people; (3) that the Roman monarchy is derived directly from God, and is not dependent on

the papacy. The *De Vulgari Eloquentia*, left incomplete, deals with the question of the Italian language and its various dialects, and with the art of poetry in general. Also in Latin are two *Eclogues*, pastoral poems in hexameters, addressed to a friend in Bologna, a short treatise entitled *Quaestio de Aqua et Terra*, and 10 letters, the authenticity of many of which has been questioned. The more important of these are the letter to Can Grande, mentioned above, and one addressed to the Emperor Henry VII. See also ITALIAN LITERATURE. B. Mi.

BIBLIOGRAPHY.—*Opere di Dante*, ed. by M. Barbi, Società Dantesca Italiana, Florence, 1921; *Oxford Dante*, ed. by E. Moore, 1904, revised ed. by P. Toynbee, 1923; *Divina Commedia*, English trans. in blank verse by H. F. Cary, 1814, numerous editions, and by C. E. Norton, new ed. 1920, C. A. Dunsmore, *Aids to the Study of Dante*, 1903; G. Santayana, *Three Philosophic Poets*, 1910, C. A. Dunsmore, *Life of Dante*, 1919, B. Croce, *Poetry of Dante*, trans. 1922; E. Gardner, *Dante*, new ed. 1923; G. Leigh, *New Light on the Youth of Dante*, 1930.

DANTON, GEORGES JACQUES (1759-94), French Revolutionary leader, was born at Arcis-sur-Aube, Oct. 26, 1759. After a hobbledehoy youth, he showed great brilliance in his studies, and in 1787 became an advocate. A man of wide learning and a celebrated orator, he early displayed a revolutionary spirit, and he quickly attained prominence when the Revolution broke out. In 1791 he founded the famous Club of the CORDELIERS. By 1792 he was one of the foremost radical leaders. He was largely responsible for the organization of the National Convention, of which he became president in 1793. Danton urged the execution of the king, supported the establishment of the Revolutionary Tribunal, and was for a time head of the Committee of Public Safety. He tried to moderate the Terror and thereby incurred the displeasure of Robespierre, who succeeded in discrediting him and his friends and sending them to the Paris guillotine on Apr. 6, 1794.

BIBLIOGRAPHY.—H. Belloc, *Danton*, 1928.

DANUBE, the largest and most important river in Europe, ranking second to the Volga. The union of the Brege and Brigach rivers in southwest Germany, at Donaueschingen in the eastern hills of the Black Forest, form the Danube, which is 1,750 mi. long and drains an area of over 300,000 sq. mi. In its early upper course it runs generally east through Germany, traversing a wild, romantic country, with many castle-crowned hills. During its passage from Ulm to Ratisbon, the farthest point navigable for large boats, it is joined by the Iller, Lech, Altmühl and Naab. The Isar is the next important affluent, before the Inn and Salzach rivers enter the stream. The Danube flows into Austrian territory, going generally east past Linz and Vienna, whose music and literature teem with allusions to "the beautiful blue Danube." Here its principal tributary is the Enns. In Austria the stream is hemmed in by narrow mountains for a portion of its course, winds through a broad valley, encounters a whirlpool near Grein, and then narrows again. This territory abounds in legendary and historical interest, as well as in picturesque

and beautiful scenery. Below Vienna the Morava meets the river.

The Danube then flows on beyond Bratislava, Czechoslovakia, into an area rich in minerals, and the home of a well advanced Czech population. Next it cuts south and east to form the boundary between Czechoslovakia and Hungary, which it enters at Esztergom; here its confluence with the Hron and Ipel occurs. The river then turns its course southward through the great Hungarian plain past Budapest, and thence in a southeasterly direction through the northeastern corner of Yugoslavia. Its important affluent in Hungary is the great River Tisza. Its first large Yugoslavian tributary is the Drave. At Belgrade the Sava and Drina join the main stream. The Danube forms the boundary for a short distance between Yugoslavia and Rumania. At Orsova it meets the "Iron Gate," a broad, rocky portion of the river bed whose waterfalls, whirlpools and other obstructions have been largely eliminated by improvements undertaken at intervals since the middle of the nineteenth century at a cost of millions of dollars. It flows on eastward through a sparsely settled and generally undeveloped region, as it forms the boundary between Rumania and Bulgaria, widening out to receive the Oltu and other tributaries. Then it turns east and north into Rumania, with swampy land on its north bank and low hills on its south. Here the river is very important in the economic life of Rumania, where immensely rich fisheries and the products of the fertile soil bordering its banks maintain a populous countryside. Its last large affluents are the Pruth and Sereth. The Danube debouches into the Black Sea through several mouths, the most important of which is the Sulina, dredged continually to render it navigable. Galatz and Braila, accessible to seagoing boats, are leading ports at the head of the river's delta, which covers an area of over 4,000 sq. mi. and is for the most part a broad expanse of low marshland. The river receives about 300 tributaries, one-third of which are important and navigable. Vessels ply up and down the stream for almost its entire length. The Ludwigskanal connects it with the Rhine.

The Danube is the chief water highway of Southern Europe. It has profoundly influenced not only the geography, but also the political history of the countries which it traverses. In 1856, it was declared free to the commerce of all nations. At the Berlin Conference in 1878, it was agreed that no ships of war should navigate the Danube below the Iron Gate. River traffic is subject to the control of an international commission created by the Danube Statute of 1921 and in force since 1922.

DANVERS, a town of northeastern Massachusetts, in Essex Co., situated on the Boston and Maine railroad about 20 mi. northeast of Boston. In a dairying, poultry-raising and farming region, it is an important trading center, and manufactures leather goods, lamps and radio equipment. In 1929 the retail trade amounted to \$3,645,236. Located here is St. John's

Preparatory College and the State Insane Asylum. Danvers is in the region of the witchcraft disturbances of the late 17th century. It is the birthplace of ISRAEL PUTNAM and at one time was the home of JAMES GREENLEAF WHITTIER. Pop. 1920, 11,108; 1930, 12,957.

DANVILLE, a city of eastern Illinois and county seat of Vermilion Co., on the Vermilion River, 120 mi. south of Chicago. Railroads serving Danville include the Chicago and Eastern Illinois, the New York Central and the Wabash lines, and an electric railroad. The city is located on the Dixie State Highway and has a commercial airport. There are railroad shops, brick- and iron-works, lumber mills, and hardware factories. In 1929 the value of the factory output was about \$14,000,000; the retail trade amounted to \$24,421,788. The region has substantial coal deposits and farms specializing in dairy products and live stock. A branch National Soldiers' Home is located in Danville. "Uncle Joe" (JOSEPH GURNEY) CANNON, a member of Congress for 46 years and speaker, 1903-11, had his home in Danville. The city was named after Dan Beckwith, a trader who settled in 1824 on the original site of a Piankashaw Indian village. It was incorporated in 1869. Pop. 1920, 33,776; 1930, 36,765.

DANVILLE, a city of central Kentucky, the county seat of Boyle Co., in the Blue Grass region, 36 mi. southwest of Lexington. Bus lines and the Southern Railroad serve the city. There is an airport. The city has important stock yards, as well as flour and lumber mills. The surrounding agricultural region produces grain and tobacco. The city is the seat of Centre College, Kentucky College for Women and Kentucky School for the Deaf. Danville was settled in 1774, built on Wilderness Road. Near by are Dix Dam and Herrington Lake, the latter an artificial body of water produced by the hydroelectric power plant on the Dix River. Pop. 1920, 5,099; 1930, 6,729.

DANVILLE, a borough in eastern Pennsylvania, the county seat of Montour Co. It is situated on the Susquehanna River, 110 mi. northwest of Philadelphia and served by three railroads. It is an iron and steel mill community. Although iron ore has been exhausted in this vicinity, the mills are supplied with ore from other parts of the state. There are also silk, hosiery and various other manufactures. A large quantity of limestone is quarried nearby. Danville is in an agricultural district, at the foot of the Montour mountains. It was settled in 1776, laid out in 1792, and called Dan's Town. In 1845 the first "T" rail was made in Danville. Pop. 1920, 6,952; 1930, 7,185.

DANVILLE, a city near the southern boundary of Virginia, in Pittsylvania Co. It is situated on the bluffs of the Dan River, 140 mi. southwest of Richmond, 235 mi. from Washington, D.C. It is served by two railroads. Danville is an important market and center for tobacco, and has cotton, silk, hosiery, lumber and tobacco mills and other varied industries. In 1929 the manufactures reached an approximate total of \$9,000,000; the retail trade in 1929 amounted

to \$12,113,975. Danville was founded in 1770, incorporated in 1793 and became a city in 1890. After the fall of Richmond, Danville became the last capital of the Confederacy. Pop. 1920, 21,539; 1930, 22,247.

DANZIG, a free city situated 4 mi. from the Baltic Sea on the left bank of the VISTULA RIVER, and 250 mi. by rail from Berlin. Danzig and the surrounding territory which together compose the free state embrace an area of 754 sq. mi. On account of its highly favorable location at the mouth of the Vistula, Danzig is one of the most important centers of shipping in Europe. It contains large warehouses for its products and has excellent shipping facilities. The city is connected by rail with the main European railroad systems and is the terminus of important air routes. The principal exports are grain, sugar, cement, timber, iron, steel and coal. The imports include raw cotton, textiles, foodstuffs, chemicals, machines and scrap-iron. In 1929 Danzig had 58 vessels of all descriptions, with a gross tonnage of 132,405. In 1928 a total of 6,198 vessels of 4,045,237 tons entered the harbor and 6,950 vessels of 3,899,854 tons cleared from it. In the same year the exports in tons were: lumber, 914,000; grain, 79,000; sugar, 105,000; coal, 5,363,000. Danzig was the capital of West Prussia until the end of the World War. By the TREATY OF VERSAILLES the Allied Powers established the city and the surrounding territory as a free state under the protection of the League of Nations. The Polish government is intrusted with the conduct of the foreign affairs of Danzig and a customs union exists between Poland and the city. Danzig has its own currency, the gulden, which is equal to one twenty-fifth of a pound sterling. Pop. 1929, 407,517.

DAPHNE, in mythology, daughter of the river god Ladon, a nymph loved by APOLLO. Fleeing from him, she was changed into a laurel tree by her mother Ge. This tree was ever after sacred to Apollo. The name "Daphne" also signifies a grove and sanctuary of Apollo near Antioch.

DAPHNE, a numerous genus of shrubs of the mezereum family, comprising about 40 species native to Europe and Asia, several of which are grown as ornamentals. Among the best known is the mezereum (*D. Mezereum*).

DAPHNIS AND CHLOË, two lovers in a pastoral romance in Greek prose by LONGUS. The interest centers around the idyllic love of Daphnis and Chloë, two children found by shepherds on the island of Lesbos. They grow up both unaware that each is in love with the other. After finding their parents they marry, the only other notable incident being that of Chloë's abduction by a pirate. Undoubtedly the finest translation is that of JACQUES AMYOT, published in French in 1559, which has influenced many modern authors. The best in English is perhaps Rowland Smith's, published 1885.

DARBHANGA, the name of a city, district and *raj* in the Tirhut division of Behar and Orissa, British India. Situated on the Little Baghmata River and served by the State railway, Darbhanga centers

around the maharaja's modern residence. It has a medical college, a hospital and large water tanks. Saltpetre, oilseeds and timber are the chief exports. The district of Darbhanga is an alluvial plain watered by the rivers Ganges, Burh, Baghmata, Little Baghmata, Balan, Little Balan and Gandak. Rice, tobacco and sugar-cane are the principal crops. Area 3,348 sq. mi. The *raj*, or State of Darbhanga, founded in the 16th century, includes parts of the districts of Darbhanga, Bhagalpur, Purnea, Muzaffarpur and Monghyr. It is held by the hereditary Maharajadhiraj of Darbhanga. Pop. 1921, city, 53,700; district, 2,913,529; 1931, district, 3,105,529.

D'ARBLAY, MADAME. See BURNEY, FANNY.

DARBY, a residential and industrial suburb, a borough of Delaware Co., Pa., about 6 mi. southwest of Philadelphia near the Delaware River; it is served by two railroads. The industries are cotton, wool, yarn, water filter, and tank and button manufacture. Pop. 1920, 7,922; 1930, 9,899.

DARDANELLES, the narrow straits connecting the Aegean Sea with the SEA OF MARMORA, are about 50 mi. long and from 3 to 4 mi. wide. Their position is of great strategic importance, commanding the passage to Constantinople and the west from the Mediterranean and the Atlantic Ocean. They have been an international problem ever since the Turks set foot on European soil and they are among the most strongly fortified straits in the world. GALLIPOLI is at the northwestern entrance.

DARDIC, a group of languages of which Kaçmiri is the best known representative, spoken by some 2,000,000 persons in Dardistan, south of the Hindu Kush. It falls into four groups (Kafir, Chitrali, Dard and Kohistani) with at least 19 dialects; and is of linguistic interest as representing a transition between the Iranian and Indian branches of INDO-IRANIAN.

BIBLIOGRAPHY.—G. A. Grierson, *Linguistic Survey of India*, 1919.

DAR-ES-SALAAM, a port of TANGANYIKA, situated on the east coast of Africa. It is a modern Arab city of 25,000 inhabitants, with a central location, and the best harbor on the coast. A large proportion of the copper, cotton and peanut export of Belgian Congo and central Africa passes through Dar-es-Salaam. The terminus of the Central Railway, the city has taken much entrepôt trade from Zanzibar.

DARIEN, a district along the eastern coast of the isthmus connecting South and Central America, most of which lies within the Republic of Panama. The Spaniard Rodrigo Bastidas first explored the district in 1501. Twelve years later Balboa saw the Pacific Ocean from one of its peaks. In 1698 Scottish colonists established settlements and named the territory Caledonia. A year later, discouraged by illness and scarcity of food, they abandoned their settlements. Later attempts by the Scotch to colonize Darien likewise proved unsuccessful.

DARÍO, RUBÉN (1867-1916), outstanding South American poet, was born, Jan. 18, 1867, at Metapa,

Nicaragua. He very early revealed the gifts that were to distinguish him, and his first verses were written during his 11th year.

At 13 Darío discovered the noble figure, Juan Montalvo of Ecuador, famed for his spirited resistance to political tyranny. Thus inspired, Darío penned an attack on the government, in the columns of *La Verdad*, León, and was imprisoned. Shortly after, he engaged in journalism at Managua, and, had he been able to restrain his lyrical, libertarian impetuosity, would have received a pension for European travel. Another outburst of radical verse, however, lost him this opportunity. Through friends he managed to procure a position in the National Library of Managua, and it is here that his career may really be said to have begun. A sinecure, the position provided for the literary youth an opportunity to go through the Spanish classics, as printed in the renowned collection entitled *Biblioteca de autores españoles*. When, later, Darío began his epochal reform of Castilian prose and poetry, he had a thorough foundation upon which to build his reconstructions and innovations.

In Salvador, Darío met a new influence in the personality of the poet, Francisco Gavidia, who introduced him to the treasury of the modern French poets. From this point onward, the effect of the modern French school is discernible in everything that Darío writes, and through his triumphs it takes hold of the poetic youth of the Spanish world. From now on his life became a hurried passage from one country to another, and from continent to continent. In 1886 he wrote for *La Época*, in Chile; in 1889 he was back in Nicaragua; Costa Rica and Spain knew him; in 1893 he went to Argentina, at the end of the Spanish-American war he was sent by *La Nación* of Buenos Aires to Spain, and there consolidated the reputation that had burst upon him with the publication of *Azul* in 1888; and in 1899 he visited Paris. The rest of his life, marred by declining health, was a wandering of the body and the spirit through many countries of the earth and of the mind. He was always receiving sinecures in the form of diplomatic appointments; thus he served, in 1906, as Secretary of the Nicaraguan delegation at the Pan-American Congress held at Rio de Janeiro. The next year found him at Mallorca, seeking health in retreat, and toying with holy thoughts as an antidote to the bacchic paganism that held him in life-long thrall. In 1912 he made a tour of Spanish America in the interests of a new magazine, *Mundial*, of which he was the nominal head. Two years later, after an interlude in Paris, he visited New York; here, although he was honored by a few learned societies, nobody really knew him. The poet returned to his homeland and died at León, Feb. 6, 1916.

Darío's work represents a steady progress from the artificialities and precosities of *Azul* and *Prosas Profanas*, 1896, to the richer inspiration and deeper living of *Cantos de vida y esperanza*, 1905, and *El canto Errante*, 1907. To Spanish poetry he brought grace and ductility, with new visions to companion the

new technique; the French writers, especially those of the Parnassian and the Symbolist-Decadent schools, inspired him to a revolutionary revaluation of Castilian prosody. He made bold, and on the whole, very successful experiments in metrics, dissolving the almost paralytic immobility of the verse as he had found it, breathing new life into the fairly case-hardened line. His prose, which was almost as innovative as his poetry, is largely made up of his many writings for periodicals. *Azul* was partly in a poetic prose that had evil effects upon the youths who succumbed to its music without possessing sufficient personality to buttress them against its temptations. Between 1893, the year in which was published *Los raros*, a volume of criticism, and 1912, when he published his own *Life of Rubén Darío*, there appeared some 11 volumes of prose. I. G.

BIBLIOGRAPHY—I Goldberg, *Studies in Spanish-American Literature*, 1920, A. Torres-Roseco, *Rubén Darío*, 1931.

DARIUS, the name of three kings of ancient Persia. I. Darius I (ruled 521-485 B.C.) was the most important of the three. He first organized the great empire acquired by CYRUS and CAMBYSES, his predecessors. He divided it into twenty satrapies or provinces, apportioning the tribute to be paid by each satrapy into the royal treasury. He built a great road from Sardis to Susa on which he established a post service. His coinage became familiar the world over. After suppressing a revolt in Babylonia, he conducted an unsuccessful expedition against the nomadic Scythians. To punish Athens and Eretria for aiding a revolt of Greek cities in Ionia from his authority he sent an army under Mardonius, his son-in-law, which was disastrously wrecked off Mt. Athos before reaching its destination. Two years later his army under Datis and Artaphernes was defeated by the Athenians and their allies at the BATTLE OF MARATHON, 490 B.C. Before a third expedition against Greece could be fully organized Darius died. II. Darius II (ruled 423-404 B.C.), unimportant. III. Darius III (ruled 336-330 B.C.), defeated in battle at Issus in 333 B.C., and ARBELA in 331 B.C., by ALEXANDER THE GREAT, he fled towards Bactria. Before the Macedonians could overtake him he was slain by Bessus, one of his own satraps. He was the last king of the ancient Persian empire.

DARK AGES, a rather vague term frequently employed to denote the period between the 7th and 10th centuries inclusive, in the history of western Europe. It was formerly used as synonymous with Middle Ages, to characterize a period thought to be one essentially of turmoil, unlettered and barbaric. Any such extreme view has long since been abandoned by competent students; but the term may with some justice be applied to the more restricted period which followed the establishment of barbarian kingdoms upon the ruins of the Roman Empire in the west and which was rendered tumultuous by internal feud and by the invasions of Saracens, Magyars and Northmen. These centuries marked the fusion of classical and northern elements in western Europe,

and may be called "dark" both because of the low state of civilization then prevailing and by reason of our lack of knowledge of the history of that period.

DARK HORSE a person who suddenly emerges, when a party convention (*see* CONVENTION, POLITICAL) has become deadlocked, and receives the nomination as a compromise between contending factions. Thus, in the Democratic national convention of 1868, when the struggle had apparently narrowed down to two leading contestants, HORATIO SEYMOUR was nominated on the 22nd ballot, though he had previously received no votes at all.

DARLING, GRACE HORSLEY (1815-42), English heroine, was born in Bamfborough, Northumberland, England, Nov. 24, 1815. Her father, William Darling, was a lighthouse-keeper on one of the Farne Islands. During a great storm on Sept. 7, 1838, the steamship *Forfarshire* was wrecked upon the rocky shore nearby and over fifty passengers and crew were lost. While nine survivors still clung to the wreckage, Grace Darling and her father put out in a boat and, at the risk of their lives, succeeded in saving them. For this they were rewarded with a sum of money totaling about \$5,000 by the English public. Grace Darling died about four years later, Oct. 20, 1842.

DARLING, the largest river of the central lowlands of Australia, almost 1,160 mi. long, it drains an area estimated at 200,000 sq. mi. Formed by headstreams rising in the Great Dividing Range in Queensland, it flows generally southwest, through New South Wales and at Wentworth, on the boundary between New South Wales and Victoria meets the Murray River, of which it is the largest tributary. After heavy rains it receives as affluents the Warrego, Paroo, Macquarie and others. The Darling has a sluggish current. Navigation is intermittent; steamers ply as far as Walgett only during the wet season. During dry spells, boats often remain stranded in the river channel for months. Important centers along the river include Bourke and Wilcannia. In some places the banks are 30 to 40 ft. high, but floods cause the country to be inundated for miles around. The river was named for Sir Ralph Darling, governor of New South Wales early in the 19th century.

DARLINGTON, a market town and county borough of Durham, England, 232 mi. northwest of London, on the Skerne. The town's chief antiquity is the impressive parish Church of St. Cuthbert, 1160, a cruciform, transitional Norman structure which has been carefully restored. There are also modern public buildings, schools, a training college, and a 44-acre park. Darlington owes its growth to the opening in 1825 of the first passenger railway line in the world running between it and Stockton.

Prior to the 19th century the town was famed for textiles, but to-day these are of secondary importance to locomotive works, bridge castings, ships-engines and gun manufactures, brick making and quarrying. Pop. 1921, 66,847; 1931, 72,093.

DARLINGTON, a town of northeastern South Carolina, and the county seat of Darlington Co. It

is situated about 10 mi. northwest of Florence. Two railroads and bus lines afford transportation. The leading industry is manufacturing, the most important products being cotton, cottonseed, tobacco, veneer, lumber, brick and clay. Tobacco and cotton are raised in the region. Darlington was founded about 1785. Pop. 1920, 4,669; 1930, 5,556.

DARLINGTONIA, a genus of insectivorous plants of the pitcher plant family consisting of a single species found in California and Oregon. *See* CALIFORNIA PITCHER PLANT.

DARMSTADT, capital of the German free state Hesse, located between the Rhine and the Main rivers in undulating, wooded country. The old city is separated by the former grand-ducal palace and its spacious parks from the new city, with its wide parked boulevards and streets with frequent garden spots and plazas. While there is much manufacturing and trade, Darmstadt retains the aspect of a residential city. It has the Protestant City Church, of the 15th century, and eight other churches. The former court theatre, the museum and the newly erected monumental technological institute are outstanding. Darmstadt is mentioned in documents of the 8th to the 11th centuries; it passed from the Katzenbogen counts to the Hesse by marriage. Pop. 1925, 89,465.

D'ARSONVAL. *See* DIATHERMY.

DARTER, a name sometimes applied to species of ANHINGA, large, web-footed aquatic birds of warm regions feeding chiefly upon fish which they capture after pursuit under water by means of a rapid, spring-like motion of their very long necks.

DARTER, a small, brightly colored fish of the PERCH family (*Percidae*), inhabiting the small streams and brooks of the eastern and southern parts of the United States. The smaller of these fishes, some attaining a length of only 2 in., often conceal themselves on the bottom beneath stones and in the sand. If disturbed, or after food, they dart out quickly for a short space, usually returning to their old hiding place. The largest darter (*Percina rex*) ranges from 6 to 8 in. long. It is less brilliantly colored than the smaller fishes of the group, or genus (*Etheostoma*).

DARTFORD, an urban district of Kent, England, lying low in the valley of the Darent, 15 mi. southeast of London.

Dartford was the scene of Tyler's rebellion in 1377. The restored parish church boasts a Norman tower and some fine old frescoes and brasses. The Augustinian nunnery to the west, of which little survives, was at one time the private residence of Henry VIII and Elizabeth. The first manufacture of paper in England was established at Dartford by Sir John Spielman, jeweller to Queen Elizabeth, and paper-making still remains an important industry of the town. Chalk is quarried for lime and cement in the adjacent hills, and there are metal, leather and chemical manufactures. Pop. 1921, 25,952; 1931, 28,928.

DARTMOOR, high plateau in Devonshire, southwestern England. It is a wild tract approximately 200 sq. mi. in area, lying at an elevation of from 1,000 to

2,000 ft. This region comprises barren moorland, marshes, valleys and lofty heights, the tallest of which, Yes Tor and High Willhays, rise over 2,000 ft. The plateau, which slopes toward the English Channel, is the source of a number of rivers. Kaolin, obtained from the decomposed granite, tin and copper are found in the district. At Princetown is Dartmoor Prison, dating from the Napoleonic era. In many places on the moor are remains of prehistoric times. Central Dartmoor has been a royal forest for centuries.

DARTMOOR, MASSACRE OF, 1815, the killing of American prisoners of war by English soldiers. At the close of the WAR of 1812, between the United States and England, about 1,700 American prisoners were detained at the depot of Dartmoor, Devonshire, England, seven miles from Plymouth. In the severe winter of 1814-15 the suffering of the captives from want of clothing and food caused much discontent, and over-long detention after the treaty of Ghent, Dec. 1814, increased the unrest. On Apr. 6, 1815, a small riot broke out in the prison, alleged to have been partly but not wholly instigated by the Americans. The prisoners, upon hearing the alarm bell, rushed into the yard. In the confusion the governor of the prison, Capt. Shortland, ordered the prison guard to fire on the captives. Sixty-three men were killed or wounded. On June 4, 1910 a memorial to the American prisoners was placed in the church at Princetown near the prison.

DARTMOUTH, a town in Halifax Co., Nova Scotia, Canada, on Halifax Harbor, 1 mi. north of Halifax. Situated in an agricultural and industrial district, Dartmouth is second only to Sydney as a manufacturing center of Nova Scotia. There are sawmills, sugar and oil refineries, foundries and fisheries. Gold is mined in the vicinity. The town is near the beautiful Dartmouth Lakes and Dartmouth Park. Founded in 1750, it was incorporated in 1873. Pop. 1921, 7,899; 1931, 9,100.

DARTMOUTH, a town incorporated in 1664 comprising four villages in Bristol Co., southeastern Massachusetts. The largest village, Padanaram, is situated on the Apponagansett River, near Buzzard's Bay, 5 mi. south of New Bedford. Dartmouth is in a delightful summer resort section, and is a market center for poultry and dairy products. A branch of the New York, New Haven and Hartford Railroad runs through the northern section of the town. There is a box-board factory. Pop. 1920, 6,493; 1930, 8,778.

DARTMOUTH COLLEGE, a non-sectarian college for men, organized in 1769 and situated at Hanover, N.H. It had its origin in Moor's Indian Charity School, founded in 1750 at Lebanon, Conn., by Eleazer Wheelock. This school, after £10,000 had been solicited for the purpose by Samson Occom in England and Scotland, was moved to Hanover and renamed after the Earl of Dartmouth. The college includes Dartmouth College; the Chandler Scientific Course; Thayer School of Civil Engineering; Amos Tuck School of Administration and Finance and a Medical School, which ceased in 1914 to confer the

M.D. degree. The Fisher-Ames Library contains 328,905 books. In 1931-32 Dartmouth enrolled 2,376 students and had a teaching staff of 304, headed by Pres. ERNEST M. HOPKINS. The total productive funds amounted to \$15,627,866.

DARTMOUTH COLLEGE CASE, a decision of the United States Supreme Court, 1819, highly important in limiting state sovereignty and securing the inviolability of private trusts. The charter of DARTMOUTH COLLEGE, 1769, gave the trustees full power to govern the college and to fill all vacancies in their own body. The legislature of New Hampshire in 1816 passed an act amending the original charter, bringing the government of the college under the control of the state. The college began legal action which ultimately brought the case to the Supreme Court, where DANIEL WEBSTER delivered the main argument for the trustees and WILLIAM WIRT spoke for the state. The decision, handed down by Chief Justice Marshall (see MARSHALL, JOHN) declared that the action of the legislature was unconstitutional and void; that the college was a private corporation, and a state statute which attempted to change the charter without the consent of the corporation was a violation of the provision of the Federal Constitution that no state should pass any law impairing the obligation of contracts. The Dartmouth College case, because of its bearing on the sanctity of contracts, has been cited in judicial opinions almost 1,000 times, more frequently than any other in the American reports.

DARWEN, a municipal borough of Lancashire, England, situated about 4 mi. south of Blackburn and 200 mi. northwest of London. The town is a cotton and paper making center, and ships clay products, stone and coal. Pop. 1921, 37,906; 1931, 36,010.

DARWIN, CHARLES ROBERT (1809-82), English naturalist, was born at Shrewsburyshire, Feb. 12, 1809. He came from a distinguished family, being a grandson of ERASMUS DARWIN and also JOSIAH WEDGWOOD, founder of the Wedgwood pottery works. In 1818 he entered the Shrewsbury School and seven years later began studying medicine at Edinburgh. Feeling himself temperamentally unfit for work as a surgeon, Darwin turned to theology and began preparing himself for the English clergy at Cambridge in 1827. Here he met Henslow, professor of botany, and it was through this friendship that he received his appointment as naturalist to the famous voyage of the *Beagle*. This expedition, which was to occupy such a prominent place in his life, left England in 1831. It afforded Darwin a trip round the world and enabled him to collect a vast amount of data that was of inestimable value to him in his later work. Special attention was centered upon South America including the Galapagos Islands. He visited also Australia, Tasmania and New Zealand, and various oceanic islands, as Keeling, the Maldives, St. Helena, Ascension and Tristan da Cunha. All told, the voyage occupied five years, and these years were the turning point in Darwin's career. Neither his father's pro-

fession of medicine nor the ministry, for which he was preparing himself when he sailed, was suited to him; henceforth his work was to be that of a natural scientist and in this field he stands preeminent.

Upon returning from the voyage of the *Beagle*, he settled in London but soon found the city life unsuited to his habits of research. In 1839 he had married Emma Wedgwood, his cousin, and three years later moved to Down, a quiet village not far from



DARWIN'S HOUSE AT DOWN, KENT
His study was the wing at the left

London. Here for a period of 40 years Darwin devoted himself to his studies. Collecting, observing and writing, together with regular periods of rest, were a part of his daily routine. From the days of the *Beagle* he scarcely knew a well day. A constant sufferer of pain, he was nevertheless able to turn out a prodigious amount of work. He died at Down Apr. 19, 1882, and was buried in Westminster Abbey.

Darwin's interests were many-sided. Although best known for his epoch-making work *The Origin of Species*, 1859, he carried on many other investigations of scientific importance. Among these may be cited his earlier works in geology and his later interests in botany. These include his *Geology of South America*, 1842, and *Volcanic Islands*, 1844, all of which grew out of the voyage of the *Beagle*. He also wrote *The Zoology of the Voyage of the Beagle*. In botany he published *The Fertilization of Orchids*, 1862; *The Power of Movement in Plants*, 1864; *The Formation of Vegetable Moulds through the action of Worms*, 1881; *The Effects of Cross- and Self-Fertilization*, 1876; *Different Forms of Flowers*, 1877, and *Insectivorous Plants*, 1875. Closely connected with the *Origin of Species* and growing out of it are his *Variation of Animals and Plants under Domestication*, 1868; *The Descent of Man*, 1871, and *Expression of the Emotions*, 1872.

Darwin's outstanding achievement was his masterly presentation in the *Origin of Species*, following 20 years of research, of an overwhelming array of carefully verified facts in support of the doctrine of descent from a new viewpoint. The chief tenet of the new doctrine was his clearly enunciated principle of natural selection, which has been otherwise stated as the survival of the fittest or the permanency of the best adapted. Darwin's forceful exposition of a probable cause of organic evolution transferred the theory from the realm of speculation into the field of everyday life.

Darwin's remarkable powers of observation and his unusual ability to see the significance of little things

are well illustrated in his studies of orchids and climbing plants. His patience in examining and his carefulness in generalizing have become proverbial. No matter in what field, his investigations were always carried on with the same degree of thoroughness so that his work has become a model for all scientific endeavor. Some of his conclusions have been questioned, such as his theory of pangenesis; but most of his work has stood the test of time.

BIBLIOGRAPHY.—Francis Darwin, *Life and Letters of Darwin*, 1887, and *More Letters*, 1903; E. B. Poulton, *Darwin and the Theory of Natural Selection*, 1896, and *Darwin and the Origin of Species*, 1909; V. L. Kellogg, *Darwinism Today*, 1907; J. A. Thomson, *Darwin and Human Life*, 1910.

DARWIN, ERASMUS (1731-1802), English physician and grandfather of Charles Darwin and Francis Galton, was born at Elton, Dec. 12, 1731. He was educated at Cambridge and Edinburgh. In 1756 he moved to Nottingham and later to Litchfield. In 1781 he settled in Derby, where he died April 18, 1802.

Dr. Darwin is known more for his interest in nature than for his work as a physician. He was a poet of no small merit, *The Botanic Garden* (1789) being considered his best effort in this direction. The *Zoonomia* (1794-96) was written in prose. Besides these he was the author of *Phytologia* (1799) and a posthumous work *The Temple of Nature* (1803). His work is notable for having formulated in germ the ideas that were later to be developed by his more illustrious grandson. Particularly did he stress the influence of environment on the modification of species and the factor of sexual selection.

DARWINISM, the doctrine that the evolution of animals and plants has been directed by natural selection. Within a single species there is considerable variation. Since more individuals are produced than can survive, the variants which happen to be less fitted to the conditions existing in any one locality will perish. In time this elimination of the unfit leads to a gradual improvement of the race, or at least a closer adaptation to its environment. This view was first advocated by Charles Darwin and is to-day accepted as the chief directing principle of evolution. See ORGANIC EVOLUTION.

DASHEEN. See TARO.

DASYURE, a genus of small pouched beasts of prey, widely distributed in Australia and Tasmania, where they are known as "native cats." The common species (*Dasyurus maculatus*) is about the size of a house cat, weasel-like in form, with a sharp muzzle and thick black fur conspicuously spotted with white. The bushy tail has a white tip. It is a fierce little animal, killing birds and robbing hen-roosts. The family *Dasyuridae* includes "Tasmanian devil."

DATE LINE, a somewhat irregular north-south line drawn through the Pacific Ocean, at nearly 180° longitude, and separating those places that are half a day ahead of Greenwich, from those that are half a day behind. In crossing the date line from east to west one drops a day; when crossing from west to east one has to count a day twice.

DATE PALM (*Phoenix dactylifera*), an important tree of the palm family extensively grown for its valuable fruit. The tree, second in range of usefulness only to the coconut among the palms of the world, is believed to have been originally native to oases in the deserts of southwestern Asia and northern Africa, where it has been cultivated since prehistoric times.

Drawings of the date palm have been found in ancient Egyptian monuments. Herodotus, Theophrastus, Strabo and Pliny refer to its cultivation in various regions from Babylonia to the Canary Islands. While not mentioned in the earliest Hebrew books, the palm branches borne by the people at the time of Christ's triumphal entry into Jerusalem (John 12:13) and from which Palm Sunday takes its name were probably those of the date palm.

The tree, which grows from 40 to 100 ft. high, bears at the summit of its often somewhat arched or leaning stem a crown of very large, recurved, pinnately divided, feathery leaves. From their axils are produced exceedingly numerous flowers in long branching clusters, the male and female on separate trees. The oblong fruit, 1 to 2 in. in length, which consists of sweet nutritious pulp surrounding a deeply grooved stony seed, is borne profusely in long hanging strands, a single tree frequently yielding 300 pounds.

In various parts of northern Africa, western Asia and southern Europe dates constitute the principal food of a large proportion of the inhabitants, the dried and cured fruit forming a staple article of commerce both for local consumption and for export. From the areas of the most ancient culture of the date, its cultivation has spread to many other warm dry regions. In Florida, California, and northern Mexico date palms have been grown for ornamental purposes for more than 150 years, especially at the missions founded by the Spaniards. Date culture for the production of commercial varieties of the fruit was begun in the valley of the Salt river, Arizona, in 1890-1900. Since 1904 date orchards have been established on a commercial scale in hot dry irrigated portions of the Coachella and Imperial valleys in southeastern California.

DATE SHELL or **DATE FISH**, the common name for members of a genus (*Lithodomus*) of small bivalve mollusks (*Lamellibranchia*). The date shell is a sea-dweller, and owes its name to its date-like shape. It is famous for its ability to burrow into hard substances like clay, peat, coral and even rock. Date shells of one species (*Lithodomus lithophagus*), common in the Mediterranean, made holes in the marble columns of the temple of Serapis, in Italy, which earth movements once sank some 13 feet below sea level. The animals make their homes in the burrows which they dig with the help of an acid secretion from the mantle. In California the name date shell is given to a species (*Zirphaea crispata*) of edible bivalve.

DATUM, a plane used as a surface of reference, or "zero" surface, in measuring and recording eleva-

tions. It is often termed a "datum plane." The mean level of the ocean or the mean low-water level or some other plane which is at a specified distance below either of these, may be used as a datum. For lines of levels carried over the country from ocean to ocean, the U.S. Government surveying departments use mean sea-level as a datum. See also GEODESY; SURVEYING.

DATURA, a genus of coarse, rank-scented plants of the nightshade family, comprising about 12 species of wide distribution, several of which are cultivated for their exceedingly large, trumpet-shaped flowers. They are usually bushy annuals, but include also shrubs and small trees. The garden datura (*D. Metel*), a smooth annual 5 ft. high, native to India, bears erect white flowers about 7 in. long. The tree datura (*D. arborea*), native to Peru, bears similar flowers, often 9 in. long. Here belong also the toluacha (*D. meteloides*) and the jimson-weed (*D. Stramonium*), separately described.

DAUBIGNY, CHARLES FRANÇOIS (1817-78), French landscape painter and engraver, was born at Paris, Feb. 15, 1817. He began to paint early in life and allied himself with the BARRIZON SCHOOL. As a poetic depicter of the green valleys of the rivers Oise and Seine, Daubigny is excelled only by Corot. Like Corot he loved nature in her gentler moods, and his fresh color and broad, easy handling give his quiet canvases an air of timeless tranquility. By the time of his death, at Paris, Feb. 19, 1878, he had become highly successful and his paintings continue to increase in value.

DAUDET, ALPHONSE (1840-97), French novelist, was born at Nîmes, May 13, 1840. After a difficult, unhappy boyhood, he went, at 17, to live with his brother Ernest in Paris, and found employment as secretary to the Duc de Morny. His reputation was established with his Provençal sketches, *Lettres de Mon Moulin*, 1869; *Le Petit Chose*, based on his own youth, appeared in 1868, and in 1872 the first of the famous *Tartarin* books, and the play *L'Arlesienne*. In 1874 *Fromont Jeune et Risler Aîné* marked a relatively new field of naturalistic writing, rich in humor, pathos and tenderness, and other novels followed quickly: *Le Nabob*, 1877, *Les Rois en Exil*, 1879, *Numa Roumestan*, 1881, *Sapho*, 1884, and *L'Immortel*, 1888. Daudet published two books of memoirs, *Trente Ans de Paris*, 1887, and *Souvenirs d'un Homme de Lettres*, 1888. He was a member of the Academy Goncourt from its foundation. Whether or not Daudet imitated Dickens, as has been said, his particular style was original, and his books were remarkable for their vivid life. He died in Paris, Dec. 17, 1897.

BIBLIOGRAPHY.—L. A. Daudet, *Alphonse Daudet*, 1898.

DAUDET, LÉON (1867-), French author and editor, was born in Paris, Nov. 16, 1867, oldest son of ALPHONSE DAUDET. He studied medicine, but turned to letters, and early began the violent controversial writing for which, although he wrote also novels and psychological and medical works, he con-

tinued to be chiefly celebrated. As editor in chief of *L'Action Française*, which he and CHARLES MAURAS established in 1907, he found his special place for extreme neo-royalist leadership. He was a Member of the Chamber of Deputies during 1919-24. In 1899 he succeeded his father in the Academy Goncourt. His books number more than 70 and include *La Romance du temps présent*, *La Lutte, Au balcon de l'Europe et Flammes*. As the result of accusations which he made when his son Philippe was found shot in a taxicab and declared a suicide in 1925, Daudet was imprisoned, but escaped to Belgium, and on Dec. 30, 1929, was pardoned by President Doumergue.

DAUGAVPILS (DVINSK), a city and fortress in Latvia on Lake Shtshunand to the right of the wide Duna River. It is a railroad center and has two Russian, two Catholic and two Protestant churches, a synagogue and many schools. Industrially, there are large railroad shops, lumber yards and breweries and a brisk trade in flax, grain and firewood, as well as some shipping. Founded by the Teutonic Order in 1274, it passed alternately from Polish to Russian hands and played a part in the World War. Pop., 1930, 43,226.

DAUGHTER OF THE REGIMENT, THE, an opera in two acts by GAETANO DONIZETTI, libretto by Bayard and St. Georges; première (as *La Fille du Régiment*), Paris, 1840, Milan (as *La Figlia del Reggimento*), 1840, New Orleans, 1843. In New York, Lind, Patti, Sembrich and Tetrazzini appeared in the rôle with marked success.

Abandoned as a baby on the battle field, Marie (actually the daughter of the Marquise of Birkenfeld) is discovered by the peasant Tonio. She instantly became the pet of the regiment, and later finds a suitor in her humble savior. She accepts him on condition that he goes to battle. A letter pinned to the infant's clothes, addressed to the Marchioness of Birkenfeld, presently finds its owner. At first she claims the girl as her niece, installs her in the Birkenfeld castle, and arranges for Marie's marriage to a noble. But when Marie refuses to marry, her mother reveals her true identity. Agreeing now to marry a count, Marie finds that her filial devotion is to be rewarded by permission to marry Tonio, who meantime has risen to the rank of colonel.

DAUGHTERS OF THE AMERICAN REVOLUTION, a patriotic society of women directly descended from the men who saw active service in the war for American Independence. It was organized at Washington, D.C., Oct. 11, 1890, with 18 members. Mrs. Caroline Scott Harrison, wife of President Benjamin Harrison, was the first president-general. The 816 persons whose applications were approved on or before Oct. 11, 1891, are charter members.

In its constitution the objects of the society are stated to be: "to perpetuate the memory of the spirit of the men and women who achieved American independence, by the acquisition and protection of

historical spots and the erection of monuments, by the encouragement of historical research in relation to the Revolution, by the preservation of documents and relics and of the records of the individual services of Revolutionary soldiers and patriots, and by the promotion of celebrations of all patriotic anniversaries." The society aims also to promote institutions for the general diffusion of knowledge, to cherish, maintain and extend the institutions of American freedom, to foster true patriotism, and to aid in securing for mankind the blessings of liberty.

With contributions from local chapters, the society erected Memorial Continental Hall at Washington, D.C., completed in 1907. A new addition, Constitutional Hall, containing an auditorium and library, was dedicated in 1929. An annual meeting of delegates from local chapters is held at Washington during the week in which April 19 occurs. Headquarters of the society contain a valuable historical and genealogical library and a collection of many historical relics and mementos is housed in the U.S. National Museum at Washington.

DAUGHTERS OF THE CONFEDERACY, UNITED, a patriotic society of women, founded in 1894 at Nashville, Tenn. It admits to membership the mothers, sisters, daughters, wives, widows or direct female descendants of those who served in the Confederate army and navy during the Civil War, or those who personally aided the cause of the South. Its business and objects are historical, benevolent, educational and social. The purpose is to honor the memory of those who served and those who fell in the service of the Confederate states; to protect, preserve and mark places made historic by Confederate valor; to collect and preserve the material for a truthful history of the war between the states; to record the heroic part taken by Southern women both during and following the war; and to fulfill the sacred duty of benevolence toward the survivors. The organization is made up of local groups called chapters which are subordinate to the state organizations known as divisions.

DAUGHTERS OF THE KING, an order of women, members of the Protestant Episcopal Church, with purposes akin to those of the BROTHERHOOD OF ST. ANDREW, that church's organization for men. The order of The Daughters of the King was organized in 1885 in New York City. Members are admitted at a solemn service before the altar, pledged by vows to prayer and service for the extension of God's kingdom and invested with a Greek cross fleury of silver, charged with the letters "F.H.S.," the initials of *For His Sake*, the motto of the order.

DAUGHTERS OF WISDOM (*Les Filles de la Sagesse*), a religious congregation of French origin, active in all manner of charitable works. In 1701, some patients of the hospital in Portiers, young girls of pious disposition, associated under a rule given by their director, Louise-Marie Grignon de Montfort, who was beatified in 1888. They, in turn, trained in religion the future mother superior, Louise Trichet,

who, with one companion, began teaching poor children in La Rochelle in 1715. There are now more than 4,900 religious, including lay sisters, in 420 establishments, in France, where the mother house is at St-Laurent-sur-Sèvre, La Vendée; the Netherlands; Denmark; England; North and South America; Haiti; South Africa and Italy. Of special interest is an institution they conduct in Paris, the *Asile des Vieillards*, an old people's home for artists, writers, scientists and titled personages.

DAUGHERTY, HARRY MICAIAH (1860-), American statesman and lawyer, was born at Washington Court House, O., Jan. 26, 1860, attended the public schools there and studied law at the University of Michigan, Ann Arbor, where he received the LL.B. degree in 1881. He practiced law at Washington Court House until 1890, when he served two terms as a member of the Ohio House of Representatives. He moved to Columbus in 1893 and headed the law firm of Daugherty, Todd & Rarey from 1902-21, then served as United States attorney-general in the cabinets of President HARDING and COOLIDGE until he resigned in 1924. He was acquitted of charges of conspiracy to defraud the United States Government in 1927. Daugherty collaborated with Thomas Dixon on a biography, *Inside Story of the Harding Tragedy*, published in 1932.

DAVENANT, SIR WILLIAM (1606-68), English poet and dramatist, was born of parents who had been intimate friends of Shakespeare, in Oxford, Feb. 1606, and educated at Magdalen College School and Lincoln College. His first play, *The Cruel Brother*, appeared in 1630, and on Jonson's death in 1637, Davenant succeeded as Poet Laureate. A Royalist, he suffered imprisonment several times by the Parliament, and was knighted in 1643. He became a convert to the new prosody of EDMUND WALLER, and wrote his poem, *Gondibert*, in heroic verse, upon which Dryden modeled his own. He died in Lincoln's Inn Fields, Apr. 7, 1668, and was buried in Westminster Abbey.

DAVENPORT, CHARLES BENEDICT (1866-), American biologist and zoölogist, was born in Stamford, Conn., June 1, 1866. After scientific studies at Brooklyn Polytechnic Institute and at Harvard, he taught zoölogy at Harvard until 1899. For five years he was assistant professor of zoölogy at the University of Chicago, and later became director of the Carnegie Station for Experimental Evolution at Cold Spring Harbor, L.I., making a study of heredity. He is the author of many books on zoölogy, biology, anthropology, and eugenics. During 1918-19 he was a major in the Sanitary Corps, U.S.A., and published two volumes of observations, *Physical Examination of First Million Draft Recruits and Defects Found in Drafted Men*. Other works include *Elements of Zoology*, *Eugenics* and *Experimental Zoölogy*. He is a fellow of the American Academy of Arts and Sciences, and a former president of the American Society of Zoölogists, the Eugenics Research Association, and the Galton Society.

DAVENPORT, a city in eastern Iowa, the county seat of Scott Co., situated on the Mississippi River, opposite Rock Island and Moline, Ill. Bridges and ferries connect Davenport with the opposite shore. In 1853 the first bridge across the Mississippi was constructed here. Four railroads and river craft make the city an important shipping center. Davenport Airport and flying school are located near by. Corn is the chief crop of the vicinity. The manufactures include flour and flour products, rolled oats, ready-cut houses, clothing, locomotives and other iron products. In 1929 the factory output amounted approximately to \$39,000,000; the retail trade reached a total of \$43,698,841. The Rock Island Arsenal, the United States Government munition factory, is situated on a nearby island. During the World War about 18,000 workers were employed here. The city is the seat of St. Ambrose College. Davenport was settled in 1835 by Col. George Davenport and was incorporated in 1851. Pop. 1920, 56,727; 1930, 60,751.

DAVEY, JOHN (1846-1923), American founder of tree surgery, was born in Somerset, Eng., June 6, 1846. He studied landscape gardening in England, and when 27 years old came to Ohio where for many years he experimented with the care and growth of trees. His methods of tree surgery were introduced in 1890, and are now widely used in promoting tree culture. He established the Davey Institute of Tree Surgery and wrote *The Tree Doctor* and other books. Died in Akron, O., Nov. 8, 1923.

DAVID, ST., the patron saint of Wales, was born and died in the 6th century. Little is known of his life except that he founded many churches in South Wales, and that by the time of the Norman Conquest his fame had increased to such an extent that he was canonized in 1120. St. David's Day is celebrated on Mar. 1.

DAVID, the second king of Israel. He lived probably about 1033-993 B.C., and was born at Bethlehem, the youngest son of Jesse of the tribe of Judah. The Bible narratives tell how the prophet Samuel secretly anointed David king, when he was but 18 years old and still a shepherd of his father's flocks. His subsequent personal relations with King Saul and the killing of the Philistine Goliath in single combat aroused the king's jealousy and made David an exile. He became an outlaw chief popular with the people. After Saul's death in the battle of Gilboa David, who had married Saul's daughter Michal, was crowned king of Judah, over which he reigned seven years. After the murder of Ishbosheth he became king of Israel and moved his seat to Jerusalem, ever after called "the city of David." He reigned over Israel 33 years, during most of which he was engaged in wars. To him the Jews not only attribute the military organization of their nation, but also the enriching of their religious ritual with music and songs. Some modern scholars affirm that the so-called Psalms of David are by various poets. There is reason to believe that the psalmist tradition was exaggerated in the idealization of his history, but that which was exaggerated is not

thereby denied. Unlike some other Biblical characters, David has not been called mythical. A king of personal charm, he became the idealized perfect king and the prototype of the last, the Messiah. His last days were saddened by the rebellion of his son Absalom. He died at 70 years of age.

DAVID, JACQUES LOUIS (1748-1825), French painter, was born at Paris, Apr. 30, 1748. He studied with Boucher and in Rome, where he became converted to classic ideals. During the Revolution, the erstwhile painter to the king donned the "Liberty" cap and devised republican festivals upon Roman precedents. With the rise of Buonaparte, David executed the impressive *Coronation of Josephine*. Upon the Bourbon restoration, the painter was exiled to Brussels, where he died, Dec. 29, 1825. David's hard form and cold color had a bad effect on French art and the Romantic and Impressionist movements were revolts against his reactionary attitude.

DAVID, PIERRE JEAN (1789-1856), known also as David d'Angers, French sculptor and medallist, was born at Angers, Mar. 12, 1789. Upon winning the *Prix de Rome* he went to Italy, where he became a convert to the pseudo-classic art of ANTONIO CANOVA. David achieved great popularity with his 500 medallions and 150 busts, of which there is a collection at the Louvre. The Museum David at Angers possesses an almost complete collection of his original works or replicas. Other works are the statues of Gen. Gobert in Père Lachaise, and of Gutenberg at Strassburg, the *Philopomen*, a classic imitation, in the Louvre, and the pediment of the Pantheon. David died at Paris, Jan. 4, 1856.

DAVID COPPERFIELD, a somewhat autobiographical novel by CHARLES DICKENS; published 1850. This story of the hard childhood and life of David Copperfield, the author's "favorite child," contains many of Dickens's most beloved characters, and may be said to have immortalized the personalities of Betsy Trotwood, David's kindly old aunt; his friends, the Peggottys—the droll Mrs. Peggotty, her spouse, Barkis, and their children. Ham (the sailor who dies in a shipwreck) and Little Emily, whose heart is broken by David's old schoolmate (James Steerforth); the eccentric, long-worded Micawber; the scheming Rosa Dartle, and the smooth villain, URIAH HEPP; the hero's weak, well-meaning mother, and his stepfather, Mr. Murdstone; his first wife, the shiftless, pretty Dora; and, finally, the devoted Agnes, his second wife, who builds his happiness.

DAVIDIAN SCHOOL OF ART. See CLASSICISM.

DAVIDSON, JO (1883-), an American sculptor, was born in New York City in 1883 of Russo-Jewish parentage. His first art work was done in the evening class of a high school, and the first work to bring him recognition was a bust of his mother. At 14 he was forced to earn his own living. At 15, he won a scholarship to the Art Students' League, where he studied for three years. Later Davidson went to Yale and studied there under Prof.

McNeill, instructor in sculpture. Winning a scholarship for a sculptured group, he went to Paris in 1907 to study at the Beaux-Arts, but his attendance there lasted but a few weeks. Breaking from academic tradition, he began to model portrait busts, working with great rapidity. In this field Davidson has become especially prominent, though all of his work is notable. In 1918 he started on a series of busts of leaders of the World War, in 1916 executing what is said to be the only head of Woodrow Wilson made while in office. In the list of Davidson's sitters are J. M. Barrie, Joseph Conrad, Anatole France, Ignace Paderewski, Feodor Chaliapin, Georg Brandes, Marshal Foch, General Pershing, General Joffre, Georges Clemenceau, Robert Lansing, E. M. House, Arthur J. Balfour, Lord Northcliffe, John D. Rockefeller, R. M. LaFollette, Gandhi, Charles G. Dawes and Charles Chaplin.

DAVIDSON COLLEGE, at Davidson, N.C., an institution for men, was founded in 1837 and so named as a tribute to Gen. William Davidson. It is conducted under the auspices of the Presbyterians of North Carolina, South Carolina, Georgia and Florida, but is non-sectarian in teaching. The library contains 31,317 volumes. In 1930 there were 631 students and a faculty of 43, headed by Pres. Walter L. Lingle.

DAVIES, ARTHUR BOWEN (1862-1928), American painter, was born at Utica, N.Y., Sept. 26, 1862. He studied at the Art Institute, Chicago, and in New York, and in 1888 became a magazine illustrator. His paintings first attracted attention at an exhibition in New York in 1899. Davies was a symbolist and is best known for his paintings of abstract figures against idyllic backgrounds. Among his works are *Along the Erie Canal*, in the Phillips Memorial Gallery, Washington, D.C., *The Gradle of Ares*, Metropolitan Museum, New York, and *Leda and the Dioscuri*, Chicago Art Institute. Davies died in Florence, Oct. 24, 1928.

DAVIES, SIR JOHN (1569-1626), English poet, was born at Tisbury, Wiltshire, and was baptised Apr. 16, 1569. He was educated at Winchester College, and called to the bar in 1595. Six years later he sat in Parliament for Corfe Castle, and was successively solicitor-general and attorney-general for Ireland in the Irish Parliament, and again in the English Parliament. In 1626 he was appointed Lord Chief Justice of Ireland, but died before taking office. Among his works are *Orchestra*, a fragment; *Nosce Teipsum*, a philosophical poem; *Hymns to Astraea*, and two works on Ireland. He died Dec. 8, 1626.

DAVIES, WILLIAM HENRY (1871-), English poet, was born at Newport, Monmouthshire, Apr. 20, 1871, of Welsh parents. He received no formal education, but tramped throughout the western part of America, doing odd jobs, went frequently to England as a tender on cattle ships and peddled small merchandise in England. At 34 he published his first book of poetry, *The Soul's Destroyer*. It was followed by many others, but the collected editions, the latest

of which appeared in 1929, contain the best of his work. Davies's prose includes *The Autobiography of a Super-Tramp*, 1908, *Beggars, The Adventures of Johnny Walker, Tramp*, 1926, and *Dancing Mad*, 1927.

DAVIS, CUSHMAN KELLOGG (1838-1900), American statesman, was born at Henderson, N.Y., on June 16, 1838, but spent his youth in Wisconsin. After graduating from the University of Michigan, he was admitted to the bar in 1860. He served as a lieutenant in the federal army until 1864. Moving to St. Paul, Minn., in 1864, he became prominent in local politics, and was governor of the state from 1874 to 1876, then United States Senator from 1886 until his death. He was one of the peace commissioners at the close of the Spanish-American war. He published the essay *The Law of Shakespeare*. He died at St. Paul, Minn., on Nov. 27, 1900.

DAVIS, HENRY WINTER (1817-65), American public official, was born at Annapolis, Md., Aug. 16, 1817. Educated at Kenyon College and the University of Virginia, he later practised law in Alexandria, Va., and in Baltimore. He was elected to Congress in 1855, where he served except for the term 1861-63 until his defeat in the campaign of 1864. With the shiftings of political opposition to the Democratic Party, Davis was successively a Whig, a Know Nothing, a Republican and a member of the transient Union Party of 1860. A believer in the Union and in slave emancipation, he fought vigorously for his principles and is chiefly remembered for his opposition to many of Lincoln's policies and especially to his lenient plans for reconstruction. Davis incorporated his ideas of a severe reconstruction policy into a bill known as the Wade-Davis Bill. The bill passed both the Senate and the House to meet with a pocket veto by Lincoln. Davis died at Baltimore, Dec. 30, 1865.

DAVIS, JEFFERSON (1808-89), American soldier and President of the Confederate States of America, was born in Fairview, Ky., June 3, 1808. He attended Transylvania University, Lexington, Ky., and graduated from West Point in July, 1828. In 1833 he took part in the Black Hawk War, resigning from the army two years later to become a cotton planter in Warren Co., Miss. He was a presidential elector in 1844, and the following year was elected to Congress, where on the death of JOHN C. CALHOUN, he became leader of the Southern Democrats. During the Mexican War he commanded a regiment under his father-in-law, Gen. ZACHARY TAYLOR, and distinguished himself at Monterey and Buena Vista. In 1847 Davis was appointed to the Senate, and the same year became chairman of the committee on military affairs. He resigned in 1851 to run for Governor of Mississippi on a states' rights platform against the Union Democrat, Foote, but was defeated. On the election of President FRANKLIN PIERCE, Davis was appointed Secretary of War, which position he held for four years, becoming a member of the Senate in 1857. In 1859-60 he opposed the presidential cam-

paign of Stephen A. Douglas, and insisted that the United States uphold slavery in the territories. After the split in the Democratic party he supported Breckinridge and Lane. On the secession of his state (Mississippi) he resigned from the Senate, Jan. 21, 1861, was commissioned a major-general of the Mississippi forces, and later was unanimously chosen provisional president of the Confederate States Feb. 9, and inaugurated Feb. 18.

After the adoption of the Southern constitution Davis was again elected president on Feb. 22, 1862 and inaugurated for a term of six years. He vigorously organized the resources of the South for war, and his wise selection of commanders led to a series of victories in Virginia in 1862. Public opinion in the South turned against him at his failure to strengthen the Mississippi front, which led to the fall of Vicksburg, and at the replacement of Gen. Joseph E. Johnston by John P. Hood in the face of Sherman's march into Georgia. After Lee's surrender Davis tried to reach Mississippi, but was captured near Irwinsville, Ga. He regained public sympathy during his subsequent imprisonment and indictment for treason, and was released following the general amnesty of 1868. He died in New Orleans, Dec. 6, 1889.

BIBLIOGRAPHY—W. F. Dodd, *Jefferson Davis*; H. J. Fckenrole, *Jefferson Davis, President of the South*, Allen Tate, *Jefferson Davis, His Rise and Fall*.

DAVIS, JOHN (c. 1550-1605), English navigator, born at Sandridge, near Dartmouth, about 1550. While hunting for a northwest route to Asia in 1585-87, he explored the coasts of Baffin Bay and Greenland and discovered Davis Strait. He invented the Davis quadrant and published valuable information on navigation. During a voyage to the South Seas in 1592, he discovered the Falkland Islands. He was killed by pirates near Sumatra in 1605.

DAVIS, JOHN WILLIAM (1873-), statesman and lawyer, was born at Clarksburg, W.Va., April 13, 1873. He graduated in 1892 at Washington and Lee University, was admitted to the bar in 1895, and subsequently rose to become one of the most eminent lawyers of the day. Davis served in the West Virginia legislature in 1899, and in 1910 was sent to Congress as a Democrat. Reelected in 1912, he resigned the next year to become United States Solicitor-General, serving until 1918. As ambassador to England, 1918-21, he aided Wilson in the formulation of the Versailles Treaty. In 1924 he was chosen Democratic nominee for President, but lost the election to Coolidge. During his campaign he criticized the Harding administration and came out strongly in favor of United States' entrance into the League of Nations. Davis was elected president of the American Bar Association in 1922, and of the American branch of the International Law Association in 1930. In 1931 he was head of the Council on Foreign Relations, and of the English-speaking Union of the United States.

DAVIS, NATHAN SMITH (1817-1904), American physician, was considered the leading practitioner

of Chicago in his time. He is credited with having founded the American Medical Association in 1847. He published a history of medical education in the United States in 1851, and an extensive report on the same subject in 1877.

DAVIS, RICHARD HARDING (1864-1916), American writer, son of Rebecca Harding Davis, was born at Philadelphia, Pa., Apr. 18, 1864. He was educated at Lehigh and Johns Hopkins universities. After working for several newspapers and publishing short stories, he became editor of *Harper's Weekly*, and wrote for *Harper's Monthly*. His reputation, however, rests upon his fiction and his war correspondence. He reported the Greco-Turkish, Spanish-American, South-African and Russo-Japanese wars and, up to 1916, the World War. Among his books are *Gallagher and Other Stories*, *Van Bibber and Others*, and *Soldiers of Fortune*. Davis died at Mt. Kisco, N.Y., Apr. 11, 1916.

DAVIS CUP, the trophy emblematic of the International team championship in men's tennis. The cup was donated in 1900 by Dwight F. Davis, of St. Louis, secretary of war in 1925-29, who was American doubles champion in 1899-1901. Through the agency of this silver cup, a steadily increasing number of players representing different nations have met in friendly competition. The donor originally gave the cup to promote contests between the United States, where the game of lawn tennis was rapidly growing in popular favor, and Great Britain, whose players were the most expert at the beginning of the century. However, the number of competing nations rose from only

is held in the country of the winner in the preceding year. The Davis Cup finals consist of four singles matches between two players of each country, and one doubles match. The doubles team need not be made up of the players in the singles. The winner is best of five sets. The draw in the respective zones is made in March, and in the United States is customarily executed by the President at the White House, in the presence of the ambassadors of the competing nations in this zone. Between 1900, the beginning of Davis Cup play, and 1932, the trophy has been won 10 times by the United States, 6 times by Australasia (twice by Australia), 5 times by the British Isles, and 6 times by France. In 1901, 1910, and 1915-18 there were no matches. Scores in the Davis Cup challenge rounds are shown in the accompanying table.

DAVISON, HENRY POMEROY (1867-1922), American banker, was born at Troy, Pa., on June 13, 1867. As a youth he taught in the school that he had attended in Troy, subsequently working in a bank owned by his relatives. Anxious to work in New York, he applied, at the age of 21, for a position in a bank there, but failed to obtain it. In 1891 he once more applied for a New York job, and secured it after three interviews. He was given a position as a paying teller, but his remarkable presence of mind on one occasion, when an armed madman demanded payment of a \$1,000,000 check "for the Almighty," swiftly led to the offer of a position as assistant cashier with another bank. Davison accepted it and in five years had become president of the institution. In 1902 he became vice president of the First National Bank and in 1910 he joined the firm of J. P. Morgan and Company. When the United States entered the World War, President Wilson appointed Davison chairman of the Council of the American Red Cross. The first campaign for funds under his direction realized \$115,000,000, while the second drive, in 1918, realized the enormous total of \$170,000,000. He died at Locust Valley, N.Y., on May 6, 1922.

DAVIS STRAIT, a body of water separating Baffin Island and Greenland, and connecting Baffin Bay with the Atlantic Ocean; named in honor of John Davis, who discovered it in 1585. It is 750 mi. long and from 220 to 600 mi. wide. The coast on either side is rocky and deeply indented. The strait, although greatly encumbered with ice, is frequented by whaling ships.

DAVITS, the supporting members of an arrangement of blocks, shackles and rope for raising and lowering life boats over the side of a vessel. For vessels built in the United States the design of davits for life boats comes under the jurisdiction of the Steamboat Inspection Service. To a less extent they are used for handling the anchors forward and for holding the ship's side ladder. There are many types, varying from a single forging, to those built up of steel shapes and plates.

DAVITT, MICHAEL (1846-1906), Irish political leader, was born on Mar. 25, 1846, at Straide, Co.

Year	Winner	Loser	Score
1900	U.S.	British	3-0
1902	U.S.	British	3-2
1903	British	U.S.	4-1
1904	British	Belgium	5-0
1905	British	U.S.	5-0
1906	British	U.S.	5-0
1907	Australia	British	3-2
1908	Australia	U.S.	3-2
1909	Australasia	U.S.	5-0
1911	Australasia	U.S.	5-0
1912	British	Australasia	3-2
1913	U.S.	British	3-2
1914	Australasia	U.S.	3-2
1919	Australasia	British	4-1
1920	U.S.	Australasia	5-0
1921	U.S.	Japan	5-0
1922	U.S.	Australia	4-1
1923	U.S.	Australia	4-1
1924	U.S.	Australia	5-0
1925	U.S.	France	5-0
1926	U.S.	France	4-1
1927	France	U.S.	3-2
1928	France	U.S.	4-1
1929	France	U.S.	3-2
1930	France	U.S.	4-1
1931	France	British	3-2
1932	France	U. S.	3-2

two, in 1900, to 34 in 1928. The number fell to 25 in 1930 and rose to 27 in 1931. This increase in competitors forced the Davis Cup committee in 1923 to divide the challenging nations into European and American zones, where elimination contests are held annually in the early summer. The challenge round

Mayo. In 1870 he was arrested in London as a Fenian and spent seven years in prison. On his release he visited America to establish contact with the Fenians there. He joined Parnell in starting the Irish Land League in 1879. He was elected to the House of Commons several times after 1882, but was seated only in 1895. In the founding of the United Irish League in 1898 he cooperated with William O'Brien. Disapproving of the Boer War, he left the House of Commons and went to South Africa with the intention of arranging a European intervention. His writings include *Defence of the Land League* and *Life and Progress in Australia*. He died in Dublin on May 31, 1906.

DAVOUT, LOUIS NICOLAS (1770-1823), French marshal, was born at Annoux, France, May 10, 1770. He was trained at the military school of Brienne and entered the army. BONAPARTE, recognizing his unusual capacities, made him a general in 1800, and in 1801 a marshal. He distinguished himself at Austerlitz, Auerstädt and in the Russian campaign. Serving as minister of war during the Hundred Days, he obtained troops and supplies for Bonaparte. After Waterloo and the restoration of the Bourbons he lost his titles and prestige for a time but in 1819 was made a peer of France. He died at Paris, June 1, 1823.

DAVY, SIR HUMPHRY (1778-1829), English chemist, was born at Penzance, Dec. 17, 1778. He was an apothecary in Penzance and in 1798 became assistant to Dr. Beddoe's medical institution at Bristol where he undertook chemical research. In 1802 he became professor of chemistry at the Royal Institution, London, was knighted in 1812 and President of the Royal Society from 1820 to 1827. Davy was the founder of electro-chemistry, in 1806 deriving an electric current from chemical action. In 1807 he discovered by isolation the metals potassium, sodium and calcium and later discovered boron and chlorine and proved hydrochloric acid a combination of chlorine and hydrogen, thereby upsetting the old oxygen theory of acids and salts. The Davy lamp for safety from fire damp in coal mines was his invention. On a trip which he hoped would improve his health Davy died at Geneva, Switzerland, May 29, 1829.

DAVY JONES, in the language of sailors, a name for the evil spirit of the sea. Sailors, when speaking of a shipmate who has drowned, commonly speak of the dead man as having gone to "Davy Jones' Locker," i.e., to the bottom of the sea.

DAWES, CHARLES GATES (1865-), American financier and statesman, was born at Marietta, Ohio, on Aug. 27, 1865. He was admitted to the bar in 1887, and began practicing at Lincoln, Neb. In 1896 he was influential in securing McKinley's nomination as Republican candidate for the Presidency, and from 1897 to 1902 he was Comptroller of the Currency. In 1902 he organized the Central Trust Company of Illinois, of which he became president. With the entry of the United States into the

World War he was commissioned major, then lieutenant-colonel, of engineers, and was placed by Gen. Pershing in charge of the collection of supplies, in France, for the American Expeditionary Force; he was made brigadier-general in 1918, and served as American member of the Allied Supply Board, and at the end of the war of the A.E.F. liquidation committee. Several governments decorated him for his war services. In 1921 he organized the first United States Government budget, heading the bureau without regard to politics, and effected a saving in one year of \$250,000,000, according to official estimate. His work placed the budget on a sound foundation. He resigned from this position in June, 1922. In 1923 Gen. Dawes and Owen D. Young were named by the Allied Reparations Commission as United States members of the committee, of which Gen. Dawes was appointed chairman, which drew up the system of financial assistance to Germany known as the DAWES PLAN. With Sir Austen Chamberlain, Gen. Dawes was awarded the Nobel peace prize in 1925. In 1924 he was elected Vice-President of the United States, and in 1929 was appointed Ambassador to Great Britain, which post he resigned in 1932. In the same year President Hoover appointed him chairman of the Reconstruction Finance Corporation. He has written several books on banking and is known as a talented musician. His philanthropies include the establishment of three charity hotels, two, in Chicago and Boston, for men, and one in Chicago for women.

DAWES PLAN. The inability of Germany to pay the amount of REPARATIONS stipulated by the London Agreement in 1921, led to the occupation of the Ruhr and to the almost complete ruin of the German currency. In order to place the problem of reparations on a sounder economic basis, the Reparations Commission invited a number of experts headed by GENERAL C. G. DAWES to study the entire question and to make recommendations. In May, 1924, the Commission finished its report, which was adopted later in the same year. The experts who formulated the Dawes Plan did not have the power to fix the total amount of reparations or the total number of annuities, but were merely authorized to prepare a temporary arrangement.

The Dawes Plan made a clear distinction between the total amount to be paid by Germany and the amount which might be transferred from German marks into FOREIGN EXCHANGE. The first four years of the operation of the plan were regarded as a period of recuperation and transition during which the payments were gradually to increase. During the fifth year the ANNUITY reached a total amount of 2,500,000,000 MARKS, which was considered a standard. The following table shows the total amount payable by Germany during the first four years as well as during the standard year, and the sources from which the amounts were to be obtained.

Thus during the first year, 80% of the annuity was obtained from the foreign loan floated in 1924,

known as the Dawes Loan. In order to provide definite sources of revenue for the payment of reparations, the Dawes Plan reorganized the German railways owned by the Reich into a private company. The company then issued the equivalent of 11 billion gold marks in mortgage bonds, two billion marks in

SCHEDULE OF COLLECTIONS

(In millions of gold marks)

	First Year	Second Year	Third Year	Fourth Year	Stand- ard Year Fifth and subse- quent years
Ordinary budget					1,250
Foreign Loan	800		110	500	
Interest on railway bonds	200	595	550	660	660
Sale of railway preference shares		500			
Interest on Industrial bonds		125	250	300	300
Transport tax			290	290	290
Total	1,000	1,220	1,200	1,750	2,500

preference shares, and 13 billion shares of common stock. The bonds, carrying in a standard year a rate of interest of 5% and amortization of 1%, were turned over to the Reparations Commission. Of the two billion preference shares, 500 million REICHSMARKS were sold and the proceeds turned over to the Allies in the second year as part payment of that annuity. The 13 billion marks of common shares were retained by the German government. In addition, the Dawes Plan imposed mortgages amounting to five billion gold marks on German industry. These mortgages carried, in a standard year, a rate of interest of 5% and amortization of 1% and were also delivered to the Reparations Commission.

The standard annuity represented only a minimum amount and was subject to increase in accordance with the index of prosperity, which was based upon statistics of railway traffic, population growth, total foreign trade, consumption of tobacco, sugar, beer and alcohol, budget expenditures exclusive of reparations payments and per capita consumption of coal. No provision was made for decreasing the standard payments on the basis of the prosperity index. A further modification was provided for on the basis of changes in the value of Gold, whereby a rise or drop exceeding 10% of its value in 1928 might result, in future years, in a corresponding increase or decrease of the annual reparations payments.

In order to safeguard the German currency, a transfer committee was set up whose duty it was to transfer Reichsmarks into foreign exchange for reparations purposes, only if it did not jeopardize the stability of the German marks. Under the transfer arrangement, provision was also made as to what should be done with the accumulated amount of

Reichsmarks which could not be transferred. Amounts up to two billion marks were to be used for short term credit operations in Germany; amounts between two and five billion marks could be used by the Allies for the purchase of bonds or other form of investments in Germany; and when the total amount of these accumulated funds exceeded five billion marks, the plan provided for a decrease of payments out of the budget and the transportation tax proceeds. See also YOUNG PLAN. M. N.

BIBLIOGRAPHY—Reports of the Commissioners and Trustees, *The Execution of the Experts' (Dawes) Plan*, Geneva, 1924.

DAWN, the interval between the first appearance of a faint glow in the east and the actual rising of the sun, sometimes, however, simply indicating the time when light first limns the eastern horizon. The accompanying colors are the same as for dusk, or TWILIGHT, but occur in the reverse order. Owing to the cessation of human activities during the night as well as to the decrease in wind, the atmosphere is usually freer from dirt and smoke with the result that the colors at dawn are more brilliant than those at sunset.

DAY, WILLIAM RUFUS (1849-1923), American statesman and jurist, was born at Ravenna, Ohio, July 17, 1849. He was graduated from the University of Michigan, 1870, and after studying law at Ravenna and at the University of Michigan he was admitted to the bar in 1872. He began practice at Canton, Ohio and in 1876 upon the nomination of both the Democratic and Republican parties he was elected judge of the Court of Common Pleas. In 1889 he resigned before taking office as a Federal judge in Ohio, an office to which President Harrison had appointed him. A close personal and political friend of WILLIAM MCKINLEY, he refused the post of attorney general which the latter proffered him upon his election as president. In Mar. 1897, Day was persuaded to accept the office of assistant Secretary of State because of the waning physical powers of John Sherman, Secretary of State. In Apr. 1898, the inability of Sherman capably to continue his duties during the crucial period preceding the Spanish War led to Day's reluctant acceptance of the appointment as Secretary of State. He was generally recognized to have performed his duties with remarkable ability. In Sept. he resigned to serve with the U.S. Peace Commission at Paris where he again distinguished himself for his fairness and clear thinking. After the peace negotiations, in 1899, he was appointed judge of the United States court of appeals and in 1903 Roosevelt made him an associate justice of the Supreme Court, an office he retained until 1922. He was respected by his associate justices for his legal erudition, particularly in cases affecting interstate commerce, contracts, patents and corporate rights. In 1922 he resigned and became umpire in the Mixed Claims Commission selected to pass upon American citizens' claims against Germany. Ill health compelled him to resign this position also and he died at Mackinac, Mich., July 9, 1923. S. McK.

DAY, in astronomy, more correctly defined as the mean solar day, is the average period of time elapsing between two successive noons, where by noon is understood the time when the sun crosses the meridian. It is necessary, however, in this definition to use the word average, since, owing to the ellipticity of the earth's orbit, which results in the earth moving faster in January than it does in July, and the inclination of the axis of the earth to the ecliptic, the plane of its orbit around the sun, the apparent motion of the sun in the sky is far from uniform. For this reason astronomers have replaced the real sun by a fictitious sun whose annual, eastward motion in the sky is regular and uniform, and which always takes the same amount of time between two successive passages across the meridian. Time measured from the real noon, is called apparent solar time, and may be as much as 15 minutes fast or slow compared to mean solar time, which is determined from the fictitious sun. The difference between these two, or the difference between mean noon and real noon, is called the equation of time.

It is the mean solar day which furnishes our units of TIME, through its subdivisions into 24 hours, and the further division of each hour into 60 minutes, and of each minute into 60 seconds. The day is now always reckoned to begin at midnight, and to run until the following midnight. The sidereal day is the time that elapses between two successive passages through the meridian of the vernal equinox, a fictitious point in the sky, whose position among the stars is always known, however. The sidereal day is shorter than the mean solar day, and measures only 23 hours, 56 minutes, 4 seconds.

DAY BOOK, the book of original entry in which ACCOUNTING data are entered in chronological order and in sufficient detail to enable the bookkeeper to analyse the transactions recorded and make formal debit and credit entry in the Journal. It is usually a book of memorandum entry only.

DAY-DREAMING, the indulgence in reverie or FANTASY largely in terms of wishes of personal welfare. The imaginary companions and Utopias of children are examples of day-dreaming. The habit at times persists, and when extreme may be associated with a neurotic disposition. It is made important in Freudian psychology. See DREAMS.

DAY-FLOWER, the common name given to a large genus (*Commelina*) of the spiderwort family, comprising about 100 species widely distributed in warm and temperate regions, about 10 of which occur in North America north of Mexico. They are herbaceous plants with narrow or oblong leaves and irregular usually bright blue flowers in small clusters protruding from spathe-like bracts.

DAYLIGHT, ARTIFICIAL, a light that behaves toward all colors exactly as does natural daylight. For accurate color matching and color identification artificial daylight must not only look like daylight but must be practically identical with it in its spectrum.

Artificial daylight may be produced by several

methods: (1) directly from the light source, (2) by mixing various lights, (3) by the subtractive method, whereby excess radiation in the available light sources, which makes artificial light differ from daylight, is removed.

Artificial daylight has been produced by the first method in the Moore carbon dioxide tube. Also, it would be possible through heating some, at present unknown, solid to a temperature of 6,500° C. Tungsten, a very refractory metal, melts at about 3,600° C.

The second method has not been successful, although various mixtures of light from incandescent-filament lamps and mercury-vapor lamps, as well as neon and other GASEOUS-CONDUCTOR LAMPS, have been tried. Some of these combinations have promised an apparently white light and have been frequently so represented, but because of the omission of certain wavelengths the distribution of energy across the spectrum is banded, or not continuous.

Artificial daylight has been produced only by the subtractive method. The tungsten-filament gas-filled lamp gives the necessary continuous spectrum at a temperature of about 2,800-2,900° C., but this light differs from daylight in having excess radiation in red, orange and yellow and a deficiency in blue and violet. This excess is absorbed by properly colored glass filters. See also ILLUMINATION, ARTIFICIAL.

N.M.

BIBLIOGRAPHY.—M Luckiesh and F. E. Cady, *Artificial Daylight—Its Production and Use*, Transactions Illuminating Engineering Society, 1914; N. Macbeth, *Color Temperature Classification of Natural and Artificial Illuminants*, Transactions Illuminating Engineering Society, 1928.

DAYLIGHTING. See NATURAL LIGHTING.

DAYLIGHT SAVING TIME, used during the summer in many countries, is one hour later than the standard time. It is adopted for the purpose of having the day's work finished one hour earlier.

DAY-LILY, the common name given to a genus (*Hemerocallis*) of showy perennials of the lily family. There are about six species distributed from central Europe to China and Japan. Several forms developed in cultivation are highly prized for open planting. They bear long narrow root leaves and smooth leafless flower-stalks terminating in clusters of handsome lily-like blossoms which wither and collapse after blooming for a single day. The orange day-lily (*H. fulva*), commonly cultivated, runs wild from New Brunswick to Tennessee. The yellow day-lily (*H. flava*), also much planted in gardens, sometimes escapes to roadsides. See also CLON.

DAY LOAN, a device by which banks in New York City make unsecured loans to BROKERS for a part of one day, to enable them to obtain actual possession of the securities they have contracted to buy. With the securities as collateral, they are able to arrange for a CALL LOAN. The day loan was devised as a method of obviating the over certification of checks for brokers, which is illegal for national banks. In 1929 New York banks began to charge interest at the rate of 1% a year on this type of accommodation. See also STOCK EXCHANGE.

DAY NURSERIES, institutions which give day-time care to children of working mothers, thus constituting aid midway between institutional care and so-called mothers' pensions. Nurseries of good standards aim to provide not only satisfactory custodial care, but thorough general health service, both diagnostic and corrective; scientifically planned dietaries; an educational and mental hygiene program; and social service to nursery families. The age range of children cared for by the nurseries is from about 9 months to 6 years, and, in the case of nurseries which give out of school supervision to school children the upper age limits are 10 to 12 years.

There were in the United States in 1931 approximately 700 noncommercial and nonindustrial day nurseries with an enrollment of from 34,000 to 36,000 children. Most of this number are philanthropic organizations, privately supported, but many are conducted in connection with settlement (*see* SOCIAL SETTLEMENTS) and church groups. Supervision of the institutions is exercised through local boards of health, associations of day nurseries, councils of social agencies, state departments of welfare and the National Federation of Day Nurseries. This organization aims to unite all day nurseries in a central body, acts in a consultative and advisory capacity and in general promotes standards of child care in this field.

The day nursery originated in Paris, in 1844 and was introduced in the United States as early as 1854, when it appeared in connection with the Nursery and Child's Hospital of New York. M. F. B.

DAY OF DUPES, an incident in the establishment of the power of Cardinal ARMAND DE RICHELIEU which occurred in Oct. 1630, when the Queen-mother, Marie de' Medici, discovered that the cardinal intended to serve as minister only on condition of wielding actual power. Richelieu thought in terms of his own centralizing policy for France and did not regard either Marie de' Medici's whims, nor the importunities of her second son, Gaston. She set out to persuade the King, Louis XIII, to dismiss Richelieu; but the latter left the court before he was disgraced; whereupon the friends of the Queen-mother hastened to congratulate her and to curry her favor. Meantime the Duke of Saint-Simon, father of the historian, remonstrated with the King and had him send for Richelieu. The cardinal was reinstated before his enemies had had a moment of power; and he visited his principal opponents with disgrace, imprisonment and execution. The Marshal de Bassompierre, celebrated for his *Memoirs*, remained in the Bastille 13 years, a victim of the Day of Dupes.

J. BA.

BIBLIOGRAPHY—J. B. Perkins, *Richelieu and the Growth of French Power*, 1900.

DAYS OF GRACE, three days legally allowed to the acceptor of a bill or the maker of a note in which to make payment, in addition to the time contracted for by the instrument itself. Formerly, these extra days were allowed as a matter of favor, but the custom has grown into law and has been generally

adopted throughout the United States, where the days of grace are allowed in all states except California, Connecticut, Idaho, Illinois, Maine, Maryland, Massachusetts, Montana, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Utah, Vermont, Wisconsin, and the District of Columbia.

DAYTON, a city in Campbell Co. in northeastern Kentucky, a residential suburb of Cincinnati, situated on the southern bank of the Ohio River. It is served by river craft and the Chesapeake and Ohio Railroad. Dayton has a watchcase factory. The city was founded and incorporated in 1849. Pop. 1920, 7,646; 1930, 9,071.

DAYTON, a city and port of entry of southwestern Ohio, and the county seat of Montgomery Co., situated on the Great Miami River, about 50 mi. north of Cincinnati. It is served by four trunk railway systems and several branch railroads; in addition there are electric traction lines and various bus and motor truck lines. Hard-surfaced highways radiate in every direction from Dayton. It also has commercial and government airports, and emergency landing fields. Favored by abundant local water power, Dayton is the seat of an active and diversified manufacturing industry, whose output had a value of approximately \$316,000,000 in 1929. It is the home of the mechanical computing machine and many other mechanical devices, as cash registers, computing scales, fare recording and indicating registers, radios, autographic registers, water systems, mechanical refrigerators and automobile accessories. The city, the birthplace and home of ORVILLE and WILBUR WRIGHT and the site of some of their early experiments, is now a national aviation center. Airplane equipment is extensively manufactured here. The city is the seat of the experimental and research division of the Army Air Corps. In 1929 Dayton's 152 wholesale concerns proper distributed a total of \$71,678,393 worth of merchandise. During the same year, its 2,015 retail stores, which did an aggregate business of \$118,896,925, gave full-time employment to 10,317 persons. Purchased by a group of Revolutionary soldiers in 1795, Dayton was laid out in 1796 and incorporated as a town in 1805. It was chartered as a city in 1841. In March, 1913, a great flood swept over the Miami Valley, inundating Dayton and causing property damage estimated at \$100,000,000. To prevent recurrence of the disaster five great retarding basins with huge supporting dams were constructed and river channel improvements were instituted. Dayton adopted the commission-manager form of government in 1914. Pop. 1920, 152,559; 1930, 200,982.

DAYTONA BEACH, a city on the northeastern coast of Florida, in Volusia Co., situated on the Halifax River, 50 mi. south of St. Augustine. The Florida East Coast Railroad, bus and airplane lines serve the city. Daytona Beach is an attractive winter resort with a famous beach for automobile races. The retail business in 1929 reached a total of \$9,385,795. The city of "Daytona" was incorporated in 1876. In 1926 it was consolidated with Daytona Beach and

Seabreeze, taking the name "Daytona Beach." PONCE DE LEON visited this region in 1512; Sidney Lanier wrote of its attractions in 1875. There are many interesting Spanish remains in the vicinity. Pop. 1920, 825; 1930, 16,598.

DEACONESSSES, women set apart for church work, first appointed in apostolic times to minister to the sick and poor. St. Paul, in Romans 16:1, mentions Phoebe as a deaconess of the church. According to the *Apostolic Constitutions*, holy women were to be ordained as deaconesses because the church had need of them to instruct the female catechumens, assist the deacons in church work and prepare the bodies of women for burial. The institution reached its highest development in the 4th century, and was not widely adopted, except later among the Waldenses and the Bohemian Brethren, until modern times. Deaconesses are now attached to many ecclesiastical organizations for general parish work, religious education and missionary activities, and numerous "Homes" have been established to train them for this work.

DEACONS (Greek *diakonos*, servant), in the Catholic Church, such clergymen as have received deacon's orders from the bishop. In the present practice of the Church, the diaconate is merely a transition state before the ordination as priest. A deacon must be 21 years old, at the beginning of the fourth year of his regular theological course, and can become a priest three months after becoming a deacon. He can only preach, and may distribute Communion and baptize solemnly in exceptional cases only. In the Anglican Church the deacon must be 23, remain deacon for a year, and may read service, baptize and preach during that time. In the Methodist Church the deacon is subordinate to the ELDER. He may baptize, perform marriage ceremonies and serve as an itinerant preacher. Deacons in the Presbyterian Church are ordained by the minister to assist in the secular affairs of the church. In the Lutheran Church deacons are laymen who superintend the charities and do welfare work.

DEADLY NIGHTSHADE, a poisonous plant (*Atropa Belladonna*) of the nightshade family (*Solanaceae*), native of Europe and southwestern Asia, and important as the source of the drug belladonna and the alkaloid atropine. It is an erect branching herb of unpleasant odor, with ovate alternate leaves and greenish or dull purple flowers in their axils, followed by black berries about the size of a cherry. The whole plant is poisonous. Deadly nightshade is cultivated in Europe as a drug plant and was grown in America during the World War. The same name is sometimes erroneously applied to the black nightshade (*Solanum nigrum*), a common weed, some strains of which produce edible berries.

DEAD RECKONING, in navigation, is the name given to the method of finding an approximate position at sea from a previously determined, accurate one, by using the known direction of the course, and the known speed. *See* NAVIGATION; SEXTANT.

DEAD SEA, an undrained salt lake of southern Palestine which receives the flow of the River Jordan. The modern sea, 47 mi. long and about 10 mi. wide, represents the desiccated remnant of a vast Pleistocene lake. Its waters, rimmed with snowy deposits of gypsum and salt, fill the deepest sink of a great fault trough. Above its eastern shores the cliffs of Moab rise 4,400 ft. To the west lie the mountains of Judea. To the south stretches the desert, to the north is the broad Jordan rift.

In this arid sunken valley, evaporation is so excessive as to carry off the whole inflow of fresh water, amounting, from Jordan alone, to 6,000,000 tons a day, maintaining the lake at the lowest level of any sheet of water on the globe—1,293 feet below the Mediterranean. Next to Lake Van, Turkey, the Dead Sea is the saltiest lake in the world. Its salinity of 25% is five times that of the ocean and nearly half again that of Great Salt Lake. River fish perish as they are swept into its bitter and heavy waters. Bird life, however, abounds in the lagoons. Vegetation is scanty except along perennial streams.

Beside common salt, Dead Sea water carries vast quantities of magnesium, calcium, and potassium in chloride form, precipitates of which are slowly filling in the lake, whose level has risen 20 feet since 1883. Until recently the untold mineral wealth of the Dead Sea has been unexploited, its products being limited to salt, long a government monopoly, and bitumen, collected by the Arabs. In 1930 a British company inaugurated extensive works on the north shore, for the production of potash and other chemicals from the brine. Dead Sea potash may be thrown on the market at half the price of the German product, and in practically unlimited quantities.

DEADWOOD, a city in western South Dakota, the county seat of Laurence Co. It is situated in a narrow canyon of the Black Hills, 3 mi. north of Lead, S.D. and served by two railroads. Deadwood is surrounded by a gold-mining and stock-raising region. It is a trade and tourist center, with such enterprises as planing, quartz and cyanide mills. The site was opened up for settlement in 1876, two years after gold was discovered in Deadwood Gulch. The city derived its name from the driftwood, used as fuel, which had accumulated here. Every year a rodeo is held and an historic pageant is presented portraying the early gold rush. About 10 mi. northeast is Fort Meade, the headquarters of the Black Horse Cavalry. Pop. 1920, 2,403; 1930, 2,559.

DEADWOOD DICK, a character whose wild adventures in the West were the subject of numerous "dime novels" in the 19th century. The character is said to have been based on that of a fur trader, Robert Dickey (1840-1912).

DEAF, EDUCATION OF. The first schools for the deaf in the United States were founded in the early 19th century, Connecticut being the pioneer in this movement. These schools were modeled on institutions in Europe after considerable study by EDWARD MINER GALLAUDET and others had been made of their

methods of instruction. The sign language was adopted and used almost exclusively for 50 years. Then experiments were made in the oral method. For a time there was considerable dispute over the relative merits of the two methods; but the general tendency now is in favor of the oral system for those students who can make progress by this method, with a change to the manual classes if necessary. In some schools the two systems have been combined and proven successful. In addition to the private institutions for the deaf, there are one or more state institutions in nearly every state, and public day schools in approximately 100 cities. The total enrollment of deaf students in 1927 was 17,582, an increase of 22% over 1922. Of the outstanding schools for preparing teachers for the deaf, four are using the oral system: the Clarke School for the Deaf, the Central School for the Deaf, the School for the Deaf in New York, and the School for the Deaf in North Carolina. One, Gallaudet College, is using the manual system. The latter college, called the National Deaf Mute College when founded by Congress in 1857, gives a standard university course and is supported by the Federal Government.

DEAF-MUTISM, a condition of being both deaf and dumb. Congenital total deafness sometimes occurs, but in the majority of deaf-mutes, the deafness occurs after birth but before the acquisition of speech. In a small percentage of the cases limited speech may have been acquired, but owing to the early loss of hearing it is progressively lost until the deaf child becomes a deaf-mute.

It is estimated that in the United States there are not more than 50,000 deaf-mutes. Over 3,000,000 children of school age have some degree of impaired hearing.

Deaf-mutism is usually the result of some disease of early infancy which has produced destruction or severe injury to the hearing mechanism. This condition may remain unnoticed until long after the time the child should commence to interpret sounds into speech. Among the acute infectious diseases which may result in deafness are scarlet fever, mumps, measles, diphtheria, and intracranial or brain inflammations like epidemic cerebrospinal meningitis. Even infected adenoids and tonsils may directly incite middle ear and internal ear inflammation, and thence deafness. Statistics show also, that to a considerable degree deaf-mutism is influenced by consanguinity in parentage. Inherited diseases like syphilis are believed to exercise influence tending toward deaf-mutism.

Another type of deaf-mutism occurs in congenital absence of some portion of the perceptive or conductive hearing mechanism. However, total deafness occasionally occurs in the absence of all anatomical anomalies either of the hearing organ, of the auditory nerve or of the acoustic centers in the brain. As a rule, mutism is never accompanied by mental defects.

Absolute total deafness for all sounds, even in deaf-mutes, is a rare occurrence. Loud vibrations, like those produced by heavy trains, are perceived by

nearly all deaf-mutes. While in many instances the slight remnants of hearing are capable of being so enhanced by mechanical aids as to become exceedingly effective in the education and also in the acquisition of speech.

The various methods employed by the otologist for determining the degree of hearing loss are fully described in textbooks. As a rule, a prognosis is grave both for hearing and for the acquisition of normal speech, but most deaf-mutes may acquire a more or less distorted speech. The treatment to be employed includes: first, to overcome the deafness, if possible, and, second, to develop speech. The former involves measures for maintaining a normal condition of the nose, throat and upper respiratory tract, treatment of middle ear complications and infections of the nasal sinuses, adenoids, tonsils, also maintenance of good general health.

It is obvious, that in view of the absence of speech, the education of the deaf-mute should commence, if found early, at about the time normal speech is usually acquired. Speech development, even though abnormal, is much to be desired. The deaf watch the lip movements and the facial expressions of those who talk to them. Modern educators of the deaf-mute lay great stress also upon attention to stimulation of any residual hearing. *See also* DEAF, EDUCATION OF. W. C. P.

DEAFNESS: Temporary, due to inflammation of the Eustachian tube. *See* EUSTACHIAN TUBE; HAY FEVER.

DÉAK, FRANCIS (Ferencz) (1803-76), Hungarian statesman, was born at Sojtor, Oct. 17, 1803. He practiced law in his home county of Zala, and upon the death of his brother in 1833 was elected to his seat in the Hungarian Diet. He soon became an important factor in the turbulent politics of the time, acting as a pacifier and intermediary between opposing factions. In the Diet of 1839-40, he opposed the extreme measures proposed by the Nationalists against Austria, and brought about a more friendly understanding. He refused, however, to take part in the Diet of 1843-44, to avoid bloodshed. In 1848 he was appointed Minister of Justice, but resigned upon rupture with Austria, which his efforts failed to prevent. Upon the patching of peace with Austria, Déak returned to the Hungarian Diet in 1861, becoming leader of the Hungarian nationals and demanding of Francis Joseph the restoration of the Hungarian constitution of 1848 with the institution of a separate ministry for Hungary. After years of effort he finally gained the restoration of the Hungarian constitution on Feb. 18, 1867, when the dual Austro-Hungarian monarchy was organized and Francis Joseph was crowned king of Hungary. Déak died at Budapest, Jan. 29, 1876.

DEAKIN, ALFRED (1856-1919), Australian statesman, was born at Melbourne, Aug. 3, 1856. He attended Melbourne University and was admitted to the bar. He became active in politics, and in forming the Commonwealth of Australia, becoming in

1901 attorney general. Two years later he was elected premier, and in subsequent elections to 1910 was only defeated twice. He is the author of *Irrigation in Australia, Irrigation in Egypt and Italy*, and *Temple and Tomb*. He died Oct. 7, 1919.

DEALER, one who buys or sells without changing the nature or character of the commodity handled. The dealer is essentially a MIDDLEMAN concerned with the marketing of goods, often buying at wholesale and selling at retail. A dealer in antiques or oil paintings, however, would be likely to buy from individuals rather than wholesalers. The term sometimes has a more specific connotation in particular branches of business. The dealer in securities, for instance, buys and sells securities on his own account, and is distinguished from the BROKER who acts merely as an agent for a principal. A dealer in FOREIGN EXCHANGE is one who buys and sells BILLS OF EXCHANGE. A BANK or individuals may perform this function, buying and selling bills of exchange for importers and exporters. Again, a dealer may not always come into possession of the commodities which he buys and sells. A produce dealer may buy and sell grain which he never sees, and, in dealing in futures, he may buy and sell grain which is not yet grown. M. J. Q.

DEAN (Latin *decanus*, one having authority over ten), an ecclesiastical, civil and official title. In early times it was applied to various minor officials and also to monks having certain specific duties. From monastic usage it doubtless received its present signification as head of a cathedral chapter. At first the provost was the bishop's deputy, but later the dean took his place. The office of rural dean is an ancient institution dating from the 6th century at least, when the bishops found it necessary to subdivide their dioceses into districts. In the Roman Catholic Church the powers of rural deans, *vicars-foane*, vary greatly from one country to another. The "dean of the sacred college" is the oldest cardinal-bishop in time of service. He is next to the pope, consecrates a new pope if the elected should be only a priest, and presides at the coronation.

DEANE, SILAS (1737-1789), American diplomat, was born in Groton, Conn., Dec. 24, 1737. He graduated at Yale, studied law, and practiced at Wethersfield, Conn., where he was prominent in politics. He was sent as a delegate to the first and second Continental Congresses. His mission to France in 1776 to establish trade relations and obtain war material was successful, but he later was accused of profiteering at the expense of the colonies and was recalled. However, before returning to the United States he, with Arthur Lee and Franklin, signed treaties of commerce and military alliance with France in 1778. Although he was ably defended by John Jay and John Adams, Congress would not approve his accounts, and he returned to France, whence he retired to Holland. Settlement of the accounts was finally made by Congress in 1842 by the payment of \$37,000 to Deane's heirs. He died at sea on Sept. 23, 1789.

DEARBORN, a city of southeastern Michigan, situated in Wayne Co., 10 mi. from Detroit. The transportation facilities include the Michigan Central Railway and electric lines. Among the leading manufactures are automobiles, automobile parts, and airplanes. The retail trade amounted to \$14,175,931. The Ford experimental laboratories and the Ford model dairy farm are located in Dearborn. There is a fine public library, the gift of Mrs. Henry Ford. Dearborn was organized as a township in 1828, became incorporated early in its history, surrendered its charter, then in 1894 was again incorporated. Pop. 1920, 2,470; 1930, 50,358.

DEASE. See SIMPSON AND DEASE, EXPLORATIONS OF.

DEATH ANGEL, in botany, the name given to the deadly amanita (*Amanita phalloides*), the most virulent of all poisonous mushrooms. See AMANITA.

DEATH CAMAS, the name given to several poisonous species of ZYGADENE (*Zygadenus*), native to the western United States, which cause severe losses of sheep and cattle on stock ranges. Among the most dangerous species are the grassy death camas (*Z. gramineus*) common in Montana, Wyoming and adjoining districts; the meadow death camas (*Z. venenosus*) of the Pacific states; the foothill death camas (*Z. paniculatus*) of Utah and Nevada; and Nuttall death camas (*Z. Nuttallii*), found from Kansas to Texas. The meadow death camas is poisonous when cut with hay.

DEATH RATES. The annual number of natural deaths in the United States is approximately 1,500,000, this figure representing a death of 11.9 per 1,000 of population in 1929. This rate would be lower but for the high negro death rate, which is generally about 50% in excess of that for the whites; and for the mortality of the Indians, which is even higher than that of the negro. In 1927, the white adjusted death rate was 10.36 per 1,000 while the colored death rate was 19.54. The death rate of the United States and all other civilized countries has undergone an extraordinary reduction during the last fifty years as the result of improved sanitation, improved methods of medical and surgical practice, deliberate control of preventable disease and improved habits of living.

The available death rates for different civilized countries range from 8.5 per 1,000 for New Zealand to 26.7 for Egypt. Australia has a rate of 9.4, Holland 9.6, South Africa (European population) 10.2, Canada 10.4, Uruguay 10.7, Norway 10.8, Denmark 11.0, Germany 11.6, England and Wales 11.7, Switzerland 11.9, Sweden 12.0, Belgium 13.3, Scotland 13.3, Argentina 13.9, Irish Free State 14.2, Northern Ireland 14.4, Finland 14.6, Austria 14.9, Czechoslovakia 15.1, Lithuania 15.5, Italy 15.6, Estonia 15.9, France 16.5, Poland 16.7, Hungary 17.1, Ukraina 17.4, Spain 18.3, Philippine Islands 18.9, Salvador 19.3, Rumania 19.8, Japan 19.8, Guatemala 20.0, Korea 20.1, Ceylon 21.7, Soviet Russia 22.2, Chile 25.8, and British India 25.8.

The decline in mortality while affected by the general factors already mentioned, is particularly attributable to the reduction in deaths of infants under one year of age, and also to the decline in the deaths from acute infectious diseases of infancy and early life. Since 1900 in the states of the United States keeping these statistics, the number of deaths from typhoid fever has declined from 31.3 per 100,000 to 2.0 in 1927; from malaria from 6.2 to 0.1; from measles from 13.4 to 1.9; from whooping cough from 12.2 to 4.8; from diphtheria from 40.4 to 8.5; from pulmonary tuberculosis from 174.5 to 67.6; from diarrhea and enteritis under two years of age from 139.9 to 20.2. Conversely, however, deaths from cancer have increased from 64.0 per 100,000 to 116.1; diabetes from 11.0 to 22.3; cerebral hemorrhage from 80.7 to 97.4; diseases of the heart from 137 to 241.6; appendicitis from 8.8 to 15.2; acute and chronic nephritis from 88.7 to 95.8; suicide from 10.2 to 14.4; homicide from 1.2 to 5.0. The principal excess in the negro death rate is due to infant mortality and pulmonary tuberculosis, both being more than twice as common in the colored race as in the white race.

The increases or decreases noted are practically continuous. The outstanding and disconcerting fact lies in the continuous rise in the death rate from diseases peculiar to middle and adult life, particularly cancer, diseases of the heart and diseases of the circulatory system. Equally disconcerting are the extraordinary mortality losses due to preventable accidents, such as those caused by automobiles. In the aggregate, about 10% of the mortality is due to accidents, of which a large proportion are preventable, but which are yielding only slowly to measures of public safety. Even some of the preventable diseases, such as malaria, still prevail in certain sections to an alarming degree.

The mortality rate would be lower but for the high death rate prevailing in the negro population; but in comparison with the population of foreign countries, the United States has reached a most gratifying status in public health and in the control of diseases. Were it not for the low birth rate the population increase would be amazing. As it is, Soviet Russia is probably making the most rapid population progress. Its birth rate is the highest, while its death rate is rapidly being reduced to a figure of about 15 per 1,000. With diminished immigration the United States is facing, in the near future, the possibility of a stationary population. From a decennial rate of 36.4% of population increase during 1800-10, there has been a decline in the rate of increase to 16.1% during 1920-30. A further decline in annual growth may therefore be anticipated.

From a rough approximation, the world's birth rate may be estimated at 30 per 1,000 and the death rate at 20 per 1,000, a natural increment of 10 per 1,000, which, applied to a two billion population, gives a natural increment of two million per annum. See also MALTHUSIANISM.

F. L. H.

DEATH'S HEAD MOTH (*Acherontia atropos*), an Old World species of hawk-, or sphynx-moth,

nearby 5 in. across its spread wings. Its name is suggested by the skull-like markings on the thorax. In flight it makes a squeaking sound which together with the "death's head" have given rise to various superstitions. It often plunders beehives and its larvæ feed on potato, tomato and other plants.

DEATH VALLEY, a desert region noted for its terrific heat and great depth below sea level, situated in Inyo Co., California, near the Nevada line. It is bounded on the east by the Grapevine, Funeral and Black mountains and on the west with the exception of a few miles of the Last Chance range, by the Panamint Mountains. From Last Chance Canyon at the extreme northwest end of the valley to the southernmost point near Saratoga Springs, the valley is somewhat over 130 mi. long and attains a maximum width of 20 mi.

Mt. Telescope which towers above the valley in the Panamint range is the highest mountain in the United States whose entire height above sea level (11,045 ft.) is visible.

Death Valley is 276 ft. below sea level (U.S. Geologic Survey, 1928) and is the lowest point in the United States; the highest point, Mt. Whitney (14,501 ft.) is less than 100 mi. distant. Death Valley is one of the hottest places in the world. The official maximum temperature is 134° though undoubtedly temperatures of 150° and 160° are reached. After the few Mexicans and Spaniards who saw the valley in the early days, the first definite record begins with the forty-miners who wandered into it on their way to California and named it in grim memory of their sufferings. The presence of borax in the valley was first determined in 1880, mines were established, and until recently borax was taken out of the valley. Roads have been constructed in Death Valley and during the winter months private cars frequently enter and sight-seeing buses make regular trips. Hotels with all modern conveniences have been built at Furnace Creek and at Stovepipe Wells.

DEATHWATCH, a popular name for various small beetles (family *Anobiidae*), especially *Anobium striatum* and *Sitodrepa panicea*, which bore in wooden houses and furniture. Rapping or ticking sounds produced with their heads, apparently to attract their mates, have suggested the superstition that they are predicting death of some human inmate of the house. They destroy house-timbers, furniture, ships' stores, books, drugs and tobacco.

DÉBÂCLE, LA. See LA DÉBÂCLE.

DEBAR or **DIBRA**, a town in Yugoslav Macedonia, on the Albanian frontier. A fortified city and important as a center of commerce for the upper valley of the Black Drin River, it is the trading point for the cattle bred in the region and has a lively business in maize and tobacco. Springs of sulphur water are found near the town. The wood carvers and stone masons from Debar were famous throughout the Near Eastern world and many of the churches, mosques and monasteries in the Balkans are built by Debar masters. Before 1912 the town was part of European

Turkey. In that year the Serbians took it and in 1913 the Treaty of Bucharest gave it to them officially. Pop. 1931, 8,150.

DEBATE, formal presentation of arguments on both sides of a question by speakers who in turn present their own side of the case and reply to the arguments of their opponents. A proposition is stated which is upheld by the affirmative, and opposed by the negative side, the proceedings taking place before an audience and according to **PARLIAMENTARY LAW**. When each side has presented its arguments fully and replied to the arguments of the opposing side, the case is summed up and presented to the audience, or to a judge or judges appointed to pass upon its merits.

BIBLIOGRAPHY—W. T. Foster, *Argumentation and Debating*, 1908, V. A. Ketcham, *The Theory and Practice of Argumentation and Debating*, 1929.

DEBENTURE BONDS, unsecured **BONDS** depending for payment on the general **ASSETS** and **CREDIT** of the issuing **CORPORATION**. In general they are not considered a high grade **INVESTMENT** although they may rank high in the case of corporations maintaining strong general credit. Since no specific pledges of mortgages are made to secure government, state, municipal or other civil bonds, such issues are, by their nature, debentures. However, the taxing power and general credit of a government makes such debentures the highest grade of investments. The strength of corporation debentures depends upon general assets, the extent of bond issues having prior **LIEN**, the range of the fluctuation of earnings and the excess of average earnings over prior or preferred charges.

DEBORAH (Hebrew for bee), the warrior-prophetess of the Bible, who stirred up the Hebrews to defeat the Canaanites under Sisera. Especially famous is the so-called *Song of Deborah* in Judges 5, considered one of the earliest extant fragments of ancient Hebrew literature, and therefore of considerable historical significance. The scene of the historic encounter in which Deborah figures is probably central Palestine, and the occasion is presumably an incipient invasion which is thus happily averted.

DEBRECEN or **DEBRECZEN**, a Hungarian city in the county of Hajdu, situated at the western edge of the great fertile district of shifting sand east of the Theiss River. Once a large village of characteristically Hungarian type, it now has modern streets and promenades spreading over a large area. With the Hungarian Protestant Church as a center this city is called the *Hungarian Rome*. There are many educational institutions, including a university opened in 1914, as well as vocational schools, a printing plant founded in 1561, a museum, an art gallery and a theater. It has mills, large railroad shops, and manufactures bricks, brushes, iron and metal furniture, trading in salami, soap, lumber and leather. The city is the center of six railroad lines. The great *Hortobágy Pusztá* is characteristic of Hungary, forming an endless, treeless area of grass, with here and there shepherds' houses, surrounded by acacia groves.

The sunrise is magnificent and during July and August at noon one can often see the *Delibab*, the mirage, the *Fata Morgana* of the Puszta. A city since 1360, an important synod of the Hungarian Reformed Church was held here in 1567. During the Turkish wars it acquired economic power. In the middle of the 19th century the Hungarian Diet and Government had its seat here and Kossuth proclaimed the independence of Hungary. Three months later the city was taken by the Russians. Pop. 1930, 117,410.

DEBS, EUGENE VICTOR (1855-1926), American Socialist leader, was born at Terre Haute, Ind., Nov. 5, 1855. After attending public school he became a locomotive fireman in 1871, and in 1880 was elected secretary and treasurer of the Brotherhood of Locomotive Firemen and became editor of *The Locomotive Firemen's Magazine*. He was a member of the Indiana Legislature in 1885. In 1893 he took part in the organization of the American Railway Union, of which he was president for four years, and in 1894 as the leader in the Pullman strike in Chicago he was arrested on a charge of conspiracy to obstruct the mails. The trial for conspiracy was discontinued because of a juror's illness but he was sent to jail for six months in 1895 for violating a labor injunction. After campaigning for Bryan in 1896, he formed the remnants of the American Railway Union into the Social Democratic Party of America. For a short period a faction known as the Socialist Labor Party seceded but returned in 1899. In 1901, the party was renamed the Socialist Party of America. He was Socialist candidate for the Presidency in 1900 and in every campaign through 1920 except that of 1916, when he declined to run. A pacifist, he was convicted in Sept. 1918 of violation of the Espionage Act, and was sentenced to six years' imprisonment. As Presidential candidate, in prison, in 1920, he polled 919,799 votes. He was pardoned by President Harding in Dec., 1921. He died at Elmhurst, Ill., Oct. 20, 1926.

BIBLIOGRAPHY.—S. M. Reynolds, *Life of Eugene V. Debs*, 1910; D. Karsner, *Debs: his Authorized Life and Letters*, 1919; also Debs' own writings.

DEBT, BONDED, of a government, sometimes called funded debt, is that portion of its obligations which is represented by outstanding bonds. In contrast to the bonded debt is the floating debt, made up of currency, certificates of indebtedness and other unfunded obligations. The bonded debt may arise either from the original issue of bonds or by funding the floating debt into bonded obligations. When a bonded debt is retired by the issue of new bonds it is said to be refunded.

DEBT CONVERSION, the practice on the part of corporations or governments of changing the form of a debt, as by substituting a new issue of **BONDS** for outstanding bonds. There are several reasons why a government or a corporation may wish to convert or refund an old debt or outstanding bonds into a new form. One of these is to reduce the **INTEREST** rate or cost of carrying the debt. Another is the maturing of

old bonds or obligations at a time when it is not expedient to pay them, that is, when the money to liquidate (*see* LIQUIDATION) them can be had only by new borrowing, this being more often called refunding. A third is a desire to rearrange a debt consisting of many miscellaneous obligations into a more orderly fashion to make it more convenient to handle. A fourth is to equalize the interest rates of different issues, old and new, a reason often powerful with governments. When a FLOATING DEBT, whether represented by treasury notes, unpaid warrants or accounts current, becomes unwieldy, it may be paid off by a bond issue. This process, although it is, strictly speaking, a conversion of debt, is more often called funding or refunding.

While the general purpose of conversion is to reduce the cost of a debt to the government or to a corporation, it may be done in an effort to bolster up credit, during a period of financial strain, through the payment of higher rates of interest. Occasionally, as at the beginning of a war, the government in placing its loans promises to the buyers the right of conversion in case any later series of bonds bears a higher interest rate. This was done in the United States during the World War when $3\frac{1}{2}$ and 4% bonds were converted into $4\frac{1}{4}$ % bonds.

Conversion cannot legally be forced upon the bond holders unless the terms contained in the original agreement so specify or, in the cases of government bonds, unless the government has the right to pay off the bonds. Some Federal bonds were payable at the option of the government after 10 years, and the principal due after 20 years, thus ensuring the right to convert after 10 years. If no such right to redeem exists, the government may still convert by going into the open market and buying old bonds with the money obtained by selling new ones. Obviously, this method of conversion is not always profitable.

Corporations sometimes issue bonds convertible into Stock at the option of the holder, a privilege which is to his advantage when dividends come to exceed the interest. The advantage to the company is that it borrows on better terms if the conversion privilege is attractive and, if the bonds are actually converted, the necessity of paying interest during hard times, which is sometimes embarrassing, is removed.

C. C. P.

DEBUCHI, KATSUJI (1878-), Japanese statesman, born in Iwate-ken. He entered the diplomatic service in 1902. After holding various posts, he served on the Japanese delegation to the Washington Conference, 1921-22, and headed the Japanese delegation to settle the Shantung disposition with China in 1922. He was Vice-Minister for Foreign Affairs 1924-28, and was appointed Ambassador to the United States in 1928.

DEBUSSY, CLAUDE ACHILLE (1872-1918), French music composer, was born at St. Germain-en-Laye, Aug. 22, 1872. He studied at the Paris Conservatoire, at the age of 22 winning the Prix de Rome with his cantata, *L'Enfant Prodigue*. His output was

relatively slight, but the scrupulous artistry manifest in the limited number of his works placed him in the first rank of modern composers. As a colorist, both for the piano and for the orchestra, he had few rivals, and he virtually created a new technic for the piano. His orchestral innovations are noticeable in the orchestral poems *Nuages* and *Fêtes*, but especially conspicuous in his orchestral masterpiece *L'Après-midi d'un Faune*, while his opera *PELLEAS ET MELISANDE* is unique in the whole range of music-drama. He died at Paris, Mar. 26, 1918.

DECALOGUE (from the Greek *deka*, ten, and *logos*, word, commandment), the Ten Commandments which, according to the Bible, were revealed by God to Moses and to the Israelites on Mt. Sinai shortly after the Exodus from Egypt, about the year 1280 B.C. The Ten Commandments form the groundwork of the moral system and religion of both Christianity and Judaism. They are found, in practically identical form, in two passages of the Old Testament, i.e., in Exodus 20:2-14 and in Deuteronomy 5:6-18. The text of the fourth commandment in particular, that dealing with the observance of the Sabbath as the day of rest, evidences the most considerable differences in the two recensions. It is generally believed that the version of the Ten Commandments found in the book of Exodus is the older one.

The Decalogue represents the nucleus of the religious and moral revelation given on Mt. Sinai. Many modern Biblical exegetes are inclined to deny Moses's authorship of these Ten Commandments, whereas the Orthodox, both Christians and Jews, adhere rigidly to it. While 10 is fixed as the number of the commandments, there prevails considerable disagreement as to exactly which are the 10. Thus the view of St. Augustine, which was adopted by Luther and by the Catholic church, regards Exodus 20:2-6 as the first commandment, and Exodus 20:14 as containing both the 9th and 10th commandments. Judaism, on the other hand, following Philo and Josephus, regards Exodus 20:2 as the first commandment, Exodus 20:3-6 as the second, and the whole of Exodus 20:14 as the 10th commandment. According to the Biblical narrative, the Decalogue was originally engraved by God on two tablets of stone, which Moses broke into pieces in his fury at seeing the people worshiping the golden calf (Exodus 32); subsequently a second set of two tablets of stone containing the commandments was engraved and shown to the people, and these were thenceforth carefully preserved as sacred for hundreds of years to come (cf. I Kings 8:9).

The first commandment in the Decalogue is the solemn declaration, uttered in the first person, that Yahveh is God, who brought Israel (thee) out of Egyptian bondage; the second states, therefore, that there are to be no idols or images. The third contains the prohibition against taking the name of the Lord in vain, i.e., in false or in too frequent oaths. The fourth commandment enjoins upon Israel the observance of the Sabbath, the seventh day, as the day of

rest, and the fifth that of honoring one's father and one's mother. Murder, adultery, theft and the bearing or giving of false witness are forbidden briefly in the sixth, seventh, eighth and ninth commandments respectively, and the 10th forbids covetousness in any form whatsoever. A. SH.

BIBLIOGRAPHY.—Hastings, *Dictionary of the Bible*; Robinson, *The Decalogue*, 1899.

DECAMERON, THE, a famous collection of tales by GIOVANNI BOCCACCIO; written 1358. Drawn from *fabliaux*, from classical and Oriental sources, and from history and tradition, these renowned tales are supposed to be told by three youths and seven fair ladies who withdrew from the plague-stricken Florence of 1348 to a suburban villa. Each telling one a day, they agreed to relate 100 tales in ten days, to be based on comic, tragic, or idyllic love. Often notable for their frank sensuality, the tales are told sheerly for entertainment, and are never deeply poetical or philosophical in their implication.

DECAMPS, ALEXANDRE GABRIEL (1803-60), French painter, was born at Paris, Mar. 3, 1803. He traveled in the East and his startling color and dramatic intensity reflect his feeling for strange lands. Decamps painted horses and other animals, particularly monkeys, with affection and fidelity. His best known work, *The Monkey Connoisseurs*, is a satire of the French Academy. His biblical studies are notable for the accuracy of their background and detail. Decamps died at Fontainebleau, Aug. 22, 1860.

DECATUR, STEPHEN (1779-1820), American naval commander, was born at Sinnepuxit, Md., Jan. 5, 1779. He became a naval midshipman in 1798, and after some active service and promotion, led an expedition into Tripoli harbor, in February, 1804, to burn the American frigate *Philadelphia*, which had been taken by the Tripolitans. In reward for this feat he was made captain, and as commander of the frigate *United States* he captured the British frigate *Macedonian* in 1812. In 1813 he commanded a squadron in the harbor at New York, and, attempting to break the British blockade in 1815, surrendered his flagship, the *President*, to the enemy. He was in charge of successful naval operations against Algerian corsairs in the Mediterranean in 1815, and was made a Navy Commissioner in that year. He was the author of the famous toast, "Our country! In her intercourse with foreign nations may she always be in the right; but our country, right or wrong!" He was killed in a duel by Com. James Barron, at Bladensburg, Md., on Mar. 22, 1820.

DECATUR, a city of northern Alabama and county seat of Morgan Co., on the Tennessee River, crossed here by Keller Memorial Bridge, 86 mi. north of Birmingham. The Louisville and Nashville and the Southern railroads, and steamboat connections are the city's principal transportation facilities. Decatur is the trading center of a cotton and grain growing and coal and iron mining district, has important railroad shops, and among other products manufactures hickory wagon-spokes, boxes and baskets, iron and

steel products, and silk hosiery. The retail trade in 1929 amounted to \$7,135,436. Athens, to the north, is situated in an old aristocratic section of many architectural beauties. Pop. 1920, 4,752; 1930, 15,593.

DECATUR, a city in northwestern Georgia, the county seat of DeKalb Co., 6 mi. northeast of Atlanta, of which it is an attractive residential suburb. It is the seat of Agnes Scott College for Women and of Columbia Theological Seminary, a Presbyterian institution. Truck gardening and dairying are the chief interests. The retail business in 1929 amounted to \$4,517,188. Decatur was incorporated in 1823. Pop. 1920, 6,150; 1930, 13,276.

DECATUR, a city of south central Illinois and county seat of Macon Co., 72 mi. southeast of Peoria. It is situated on Lake Decatur, an artificial formation 12 mi. long constructed by damming the Sangamon River. Its transportation facilities include several railroad and motor bus lines. The main repair shops of the Wabash Railroad are located here. The National Airways System maintains a private airport. The city is chiefly industrial and serves as a shipping center for the grain of the agricultural district. This same district also is a fertile coal field. Corn products and plumbing equipment lead in the variety of its manufactures. In 1929 the value of the factory output was about \$51,000,000; the retail trade amounted to \$32,987,799. Decatur is the seat of James Milliken University, 1903, and also the founding place of the Grand Army of the Republic, Apr. 6, 1866. One of the parks contains the log cabin county courthouse erected in 1829, where Abraham Lincoln practiced law. The city was laid out in 1829. Pop. 1920, 43,818; 1930, 57,510.

DECATUR, a city in northeastern Indiana, the county seat of Adams Co., on St. Mary's River, about 100 mi. northeast of Indianapolis. It is served by three railroads. The city is a distributing market for dairy products, especially butter. The chief manufactures are beet-sugar, cigars, gloves, small electric motors and castings. The city was plotted in 1836, named for Com. Stephen Decatur, and incorporated in 1882. Pop. 1920, 4,762; 1930, 5,156.

DECCAN, in general, the southern part of India; sometimes the term applied to that part of the Indian peninsula lying south of the Nerbudda River; sometimes to the whole of the peninsula; and sometimes to the region between the Nerbudda and Kistna rivers which was conquered by the Mohammedan rulers at Delhi. The more restricted region is a table-land, sloping from west to east and bounded by the western and eastern Ghat ranges. Authentic history of the area begins with the period of its conquest from Delhi in 1294-1338. This was followed by a long series of conquests and re-conquests by one ruler after another, ending with British dominance.

DECELERATION. See VELOCITY.

DECEMBRISTS, adherents of a liberal Russian revolutionary movement at the death of Alexander I in 1825. During the Napoleonic Wars many Russian officers came into close contact with Western liberal-

ism. The repressive conservatism of Alexander's later ministers thus provoked the formation of numerous political clubs desirous of promoting administrative and social reforms. Among these arose the so-called Northern and Southern Unions, composed mostly of officers. Colonel Pestel, the head of the latter, actually evolved a revolutionary project for the establishment of a republic. This conspiracy became known to the government, but Alexander took no action against it. On his death, Nov. 30, 1825, the members of the Northern Union sought to profit by the confusion preceding the accession of Nicholas I to carry on revolutionary agitation among the St. Petersburg garrison. As a result, on Dec. 26, 1825, portions of two regiments staged a demonstration which was repressed by military measures. As soon as Nicholas I received the police report previously prepared for his late brother, in which the leaders of the conspiracy were listed by name, he proceeded to wholesale arrests. Five of the ringleaders, including Pestel and the poet Ryl'yeyev, were executed; the rest were permanently exiled to Siberia, and only those who outlived Nicholas I were granted amnesty by Alexander II in 1856.

DECENVIRI, a board of ten men established in ancient Rome at different times for certain religious or civil duties, the most famous of which were the *virī legibus scribendis* appointed in 451. After the *PLEBS* had gained their demands for a written law, that board replaced temporarily the consuls and tribunes for the purpose of establishing, in written form, the statutes which were later called the XII Tables.

DECEPTION PASS PARK, a state park consisting of 1,980 acres on Whidby and Fidalgo islands in Skagit and Island counties, northwestern Washington, established in 1922. The park offers excellent deep sea fishing.

DECIBEL, a unit for measuring power ratios in different parts of a group of electrical circuits handling *AUDIO FREQUENCIES*. It is 10 times the logarithm to the base 10 of the ratio of the two powers in question. This unit is used in place of the simple ratio, since it has more relation to the relative effect on the human ear resulting from sounds of different intensities. It is common practice in communication engineering to use 6 milliwatts as a base and to reckon the power ratio in audio-frequency circuits by comparison with this value.

DECIDUOUS TREES, the name applied to trees whose leaves mature and fall off at the end of a single growing season. They are thus distinguished from evergreen trees, whose leaves persist through two or more growing seasons. To the deciduous group belong most of the broad-leaved trees furnishing the hardwood timber of temperate and subtropical regions, as oak, ash, maple, beech, elm and hickory. While most coniferous trees are evergreen, a few, including the larch, tamarack and bald-cypress, are deciduous. In mild climates, as in California and Florida, important genera, for example, oak and cherry, are represented by both deciduous and evergreen species.

DECIMAL COINAGE, a monetary system in which the denominations of the principal coins are decimals of the monetary unit and the denominations of paper money and all minor coins are decimal multiples or fractions of the standard unit. In the United States the *DOLLAR* is the standard monetary unit, a *DIME* is the tenth part of such unit, and a *CENT* the 100th part. Likewise, the *EAGLE* is ten times the value of a dollar. The decimal system of monetary units, now in use in all prominent civilized countries, except England, is of great commercial convenience. The ease with which the United States system is mastered, as compared with the labor involved in learning the non-decimal tables of *WEIGHTS AND MEASURES* now in use, indicates the gain to commerce and industry afforded by a decimal system. Also, the advantages of the system in making money calculations quickly and accurately are of considerable importance.

DECIMALS, a name commonly used to mean decimal fractions. More generally, any system of notation in which the successive places from the right have ten (Latin *decem*) times the place value of the preceding ones. Our common way of writing numbers illustrates the decimal system. The first extensive use of decimals, decimal fractions, is seen in Christoff Rudolff's *Exempel-Buchlin* of 1530. He used 413 | 4375 for our 413.4375 and knew how to multiply decimals by whole numbers. Various other decimal symbols have been used, including such forms as 5/8' 0'' 4''' for 5.804, and 9625 . . . (3) for 9.625. In England the form 0/56 was occasionally used for 0.56 in the 17th century; 2.75 was not uncommon in the 18th and came into general use in the 19th. On the continent of Europe such forms as 2.75 and 2.75 for our 2.75 are common. International banking has of late tended to use the form 2.75. The decimal way of writing fractions was not commonly used in business until the close of the 18th century when the United States monetary system and the metric system in France gave it new prominence. At the present time it is almost universally used for all except such common fractions as halves, thirds, fourths, and eighths. The subject is closely related to *PERCENTAGE*. See also *FRACTIONS*. D. E. S.

DECLARATION OF INDEPENDENCE, a document enacted on July 4, 1776 by the unanimous vote of 12 American colonies (the *THIRTEEN COLONIES* excepting New York) through their representatives in the Second *CONTINENTAL CONGRESS*. Richard Henry Lee on June 7, 1776, moved "that these United Colonies are, and of right ought to be, free and independent States, that they are absolved from all allegiance to the British Crown. . . ." Final discussion was postponed until several delegations had secured instructions from their provincial legislatures. Meanwhile a committee composed of Thomas Jefferson, John Adams, Benjamin Franklin, Roger Sherman and Robert R. Livingston drew up the declaration, Jefferson assuming the actual authorship. Lee's motion was adopted on July 2. The declaration was

adopted two days later, and copies signed by John Hancock and Charles Thompson, president and secretary of the Congress, were sent to state assemblies on July 5. The document was published in the *Philadelphia Evening Post* on July 6, was ordered engrossed by Congress on July 19, and signed by members of the Congress on Aug. 2. The declaration was adopted by the Provincial Congress of New York on July 9.

The document began with a recital of "self-evident" truths; the equality of man; the inherent rights of life, liberty, property, and the pursuit of happiness; the consent of the governed as an essential basis of government; the right of revolution when governments become subversive of the ends for which they were created. There followed 18 specific arraignments of King George III, the British Parliament being ignored. Of these the charges that "he has refused his assent to laws, the most wholesome and necessary for the public good . . . has affected to render the military independent of and superior to the civil power . . . has plundered our seas, ravaged our coasts, burnt our towns and destroyed the lives of our people" are typical. Finally the pledge by the signers of "their lives, fortunes, and their sacred honor" for the maintenance of independence.

The text of the Declaration of Independence is as follows:

DECLARATION OF INDEPENDENCE.

When in the Course of human events, it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume among the powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.

We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness. That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed, That whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness. Prudence, indeed, will dictate that Governments long established should not be changed for light and transient causes; and accordingly all experience hath shewn, that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing invariably the same object evinces a design to reduce them under absolute Despotism, it is their right, it is their duty, to throw off such Government, and to provide new Guards for their

future security. Such has been the patient sufferance of these Colonies; and such is now the necessity which constrains them to alter their former Systems of Government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute Tyranny over these States. To prove this, let Facts be submitted to a candid world.

He has refused his Assent to Laws, the most wholesome and necessary for the public good.

He has forbidden his Governors to pass Laws of immediate and pressing importance, unless suspended in their operation till his Assent should be obtained, and when so suspended, he has utterly neglected to attend to them.

He has refused to pass other Laws for the accommodation of large districts of people, unless those people would relinquish the right of Representation in the Legislature, a right inestimable to them and formidable to tyrants only.

He has called together legislative bodies at places unusual, uncomfortable, and distant from the depository of their public Records, for the sole purpose of fatiguing them into compliance with his measures.

He has dissolved Representative Houses repeatedly, for opposing with manly firmness his invasions on the rights of the people.

He has refused for a long time, after such dissolutions, to cause others to be elected; whereby the Legislative powers, incapable of Annihilation, have returned to the People at large for their exercise; the State remaining in the meantime exposed to all the dangers of invasion from without, and convulsions within.

He has endeavoured to prevent the population of these States; for that purpose obstructing the Laws for Naturalization of Foreigners; refusing to pass others to encourage their migrations hither, and raising the conditions of new Appropriations of Lands.

He has obstructed the Administration of Justice, by refusing his Assent to Laws for establishing Judiciary powers.

He has made Judges dependent on his Will alone, for the tenure of their offices, and the amount and payment of their salaries.

He has erected a multitude of New Offices, and sent hither swarms of Officers to harass our people, and eat out their substance.

He has kept among us, in times of peace, Standing Armies, without the Consent of our legislatures.

He has affected to render the Military independent of and superior to the Civil power.

He has combined with others to subject us to a jurisdiction foreign to our constitution and unacknowledged by our laws; giving his Assent to their Acts of pretended Legislation: For quartering large bodies of armed troops among us: For protecting them by a mock Trial from punishment for any Murders which they should commit on the Inhabitants of these States: For cutting off our Trade with all parts of the world: For imposing Taxes on us without our Consent: For depriving us in many cases of the benefits of Trial

by Jury: For transporting us beyond Seas to be tried for pretended offences: For abolishing the free System of English Laws in a neighbouring Province, establishing therein an Arbitrary government, and enlarging its Boundaries so as to render it at once an example and fit instrument for introducing the same absolute rule into these Colonies: For taking away our Charters, abolishing our most valuable Laws and altering fundamentally the Forms of our Governments: For suspending our own Legislatures, and declaring themselves invested with power to legislate for us in all cases whatsoever.

He has abdicated Government here by declaring us out of his Protection and waging War against us.

He has plundered our seas, ravaged our Coasts, burnt our towns, and destroyed the lives of our people.

He is at this time transporting large Armies of foreign Mercenaries to complete the works of death, desolation and tyranny, already begun with circumstances of cruelty and perfidy scarcely paralleled in the most barbarous ages, and totally unworthy the Head of a civilized nation.

He has constrained our fellow Citizens taken Captive on the high Seas to bear Arms against their Country, to become the executioners of their friends and Brethren, or to fall themselves by their Hands.

He has excited domestic insurrections amongst us, and has endeavoured to bring on the inhabitants of our frontiers, the merciless Indian Savages, whose known rule of warfare is an undistinguished destruction of all ages, sexes and conditions. In every stage of these Oppressions We have Petitioned for Redress in the most humble terms. Our repeated Petitions have been answered only by repeated injury. A Prince, whose character is thus marked by every act which may define a Tyrant, is unfit to be the ruler of a free people. Nor have We been wanting in attentions to our British brethren. We have warned them from time to time of attempts by their legislature to extend an unwarrantable jurisdiction over us. We have reminded them of the circumstances of our emigration and settlement here. We have appealed to their native justice and magnanimity, and we have conjured them by the ties of our common kindred to disavow these usurpations, which would inevitably interrupt our connections and correspondence. They too have been deaf to the voice of justice and of consanguinity. We must, therefore, acquiesce in the necessity, which denounces our Separation, and hold them, as we hold the rest of mankind, Enemies in War, in Peace Friends.

WE, THEREFORE, the Representatives of the United States of America, in General Congress, Assembled, appealing to the Supreme Judge of the world for the rectitude of our intentions, do, in the Name, and by authority of the good People of these Colonies, solemnly publish and declare. That these United Colonies are, and of Right ought to be Free and Independent States; that they are Absolved from all Allegiance to the British Crown, and that all political connection between them and the State of Great Brit-

ain is and ought to be totally dissolved; and that as Free and Independent States, they have full Power to levy War, conclude Peace, contract Alliances, establish Commerce, and to do all other Acts and Things which Independent States may of right do. And for the support of this Declaration, with a firm reliance on the protection of Divine Providence, we mutually pledge to each other our Lives, our Fortunes, and our sacred Honor.

DECLARATION OF LONDON. See LONDON, DECLARATION OF.

DECLINATION, the perpendicular distance, in arc or angle, between a heavenly object and the celestial equator.

DECLINATION, MAGNETIC, the angle, at any point on the earth's surface, between the direction taken by a magnetic needle (see COMPASS) and true north. It so happens that the magnetic poles of the earth (see TERRESTRIAL MAGNETISM) are at a considerable distance from its geographical poles, and, inasmuch as the compass needle points toward the north magnetic pole, there are comparatively few places on the earth where the needle points truly north. The failure of the compass needle to designate true north was first discovered by COLUMBUS, the fact being rather disconcerting to his sailors.

By means of a TRANSIT, true north may be located by observations on the North Star. When the axis of the transit telescope is fixed in this direction, which represents the meridian of the place of observation, the angle of declination may be observed by noting the position of the compass needle on the divided circle of the instrument. If such observations are made over the entire surface of the earth and lines are drawn through those places having equal declination, a series of lines having a northerly trend are obtained. These lines, which converge at the north and south magnetic poles, are called *isogonic lines*. The lines which pass through those few points where the compass indicates true north are called *agonic lines*. S. R. W.

DECOLORIZING, the removal of color. Decolorizing may be effected in several ways, depending on the material to be decolorized and the origin of the color. Impurities in water, sugar solutions, and the like are removed by passage over adsorbents, e.g., CARBON (CHARCOAL), activated carbon (see CARBON, ACTIVATED), FULLER'S EARTH. Yellow palm oil is "bleached" by oxidizing the yellow pigment to a colorless compound; but olive and cottonseed oils are "bleached" by treatment with fuller's earth, which absorbs the coloring material. Textiles soiled by dust and dirt are decolorized by dissolving or deflocculating the coloring materials by soap and alkali solutions. Stains which withstand this treatment are converted into colorless compounds by chlorine or oxygen bleaches or sunlight (see BLEACHING), or are removed by special solvents such as carbon tetrachloride and chloroform. In printing textiles, a color may be removed by application of a *stripping agent*, e.g., a hydrosulphite, and new color, unaffected by this agent,

may be simultaneously applied. *See also* ADSORPTION; BLEACHING; PRINTING, TEXTILE. J. A.



COURTESY METROPOLITAN MUSEUM OF ART

DOORWAY, SHOWING 18TH CENTURY DÉCOR
From a drawing by J. A. Meissonnier (1693-1750)

DECOMPOSITION, CHEMICAL, the process whereby a substance breaks up into two or more substances of simpler composition, sometimes into the constituent elements themselves. In general, decomposition is greatly furthered by heat and, at very high temperatures, such as those prevailing on the surface of the sun, all compounds are decomposed and only elements exist. Light also aids decomposition; thus, photochemical decomposition of silver bromide (*see* SILVER; BROMIDES) forms the basis of photography.

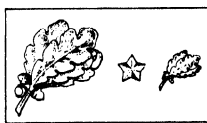
Decomposition is generally considered as taking place in one direction only; when, by a comparatively small change in conditions, the reaction is reversed, the term dissociation is usually applied. Thus, simple heating will decompose mercuric oxide into mercury and oxygen, which will not reunite upon cooling; ammonium chloride, on the other hand, is dissociated, when heated, into hydrochloric acid and ammonia, but these gases will again combine upon cooling.

The decomposition of organic material may take place under various forms, either as "rotting" or putrefaction (*see* OXIDATION), a slow process in which numerous intermediate products are formed; as simple FERMENTATION (in the formation of alcohol, from sugars and starch); or as the complete and final decomposition, occurring upon excessive heating (*see* COMBUSTION) and almost invariably resulting in the

production of water and carbon dioxide, while a residue of carbon remains behind.

DÉCOR, OVERDOOR AND OVERMANTEL, the decoration of the wall spaces above the door and mantel by painting, carving and other means. Mural decoration dates back as far as 4500 B.C. and has been practiced in every age. Its many forms include fresco, painting on canvas, plaster and gesso modeling, wood carving and ceramics. Decorations in tinted plaster and gesso relief flourished in Europe during the Renaissance and many beautiful examples exist in the palaces and public buildings of the period. In England ROBERT ADAM employed this form of overdoor and overmantel decoration, evolving a new and finely detailed technique. Painting and ceramics have an equally old and distinguished history in mural decoration. Wood carving has been especially popular in England for this purpose and magnificent specimens of the Grinling Gibbons school of the 18th century still exist. Modern architects and decorators are turning more and more to the architecture and decoration of rooms, giving special attention to the overmantel. The field is a rich one for artists.

DECORAH, a city and county seat of Winneshiek Co., northeastern Iowa, on the Oneota River, 80 mi. northwest of Dubuque, Iowa. Two railroads serve the city. Decorah is in an agricultural region producing grain and hogs. Luther College is located here. A beautiful ice cave is in the vicinity. Decorah was settled about 1849 and incorporated in 1871. Pop. 1920, 4,039; 1930, 4,581.



DECORATIONS FOR HEROIC SERVICE
Large and small oak leaf clusters and silver star

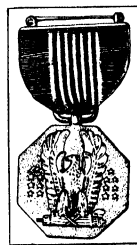
DECORATIONS, MILITARY AND NAVAL, as here employed, an emblem, medal or symbol officially awarded in recognition of heroic action or other distinguished service by a member of the military or naval establishment, to be worn as a mark of distinction.

ARMY

The Congress of the United States has established and authorized the award, through or by the War Department, of the below mentioned decorations.

Medal of Honor: In the name of Congress, for conspicuous gallantry and intrepidity in actual conflict with an enemy, involving risk of life and conduct above and beyond the call of duty. Distinguished Service Cross:

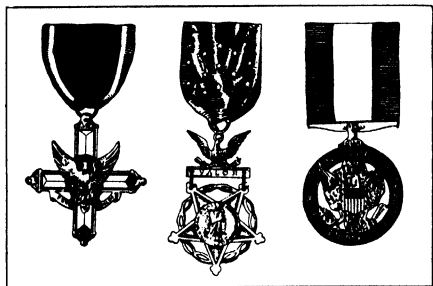
For extraordinary heroism in connection with military operations against an armed enemy. Distinguished



SOLDIER'S MEDAL
FOR VALOR,
UNITED STATES

Service Medal: For exceptionally meritorious service to the Government in the performance of duty involving great responsibility. **Soldier's Medal:** For heroic service not involving actual conflict with an enemy. **Dis-**

tinguished Flying Cross: For heroic conduct or extraordinary achievement while participating in an aerial flight. Oak Leaf Cluster: For each succeeding deed or act warranting award of a medal of honor, distinguished

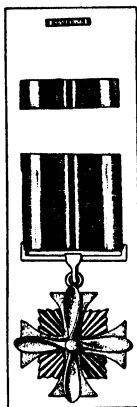


DECORATIONS AWARDED BY THE UNITED STATES

Left: Distinguished Service Cross (Army). The Navy Cross is given for similar service. Center: The Medal of Honor (Army, Navy), the highest decoration given by the United States. Right: Distinguished Service Medal (Army, Navy)

service cross or distinguished service medal, respectively, instead of an additional medal of honor, distinguished service cross or distinguished service medal.

Silver Star: For gallantry in action cited in orders from the Headquarters of a general officer's command but not warranting the award of a medal of honor or distinguished service cross.



DISTINGUISHED FLYING CROSS, UNITED STATES

By act of Congress or in Army Regulations, provision has been made for the award of medals indicative of service in the United States Army during certain wars, campaigns and other military operations. The service to be commemorated by each of these medals, which are classed not as decorations but as service medals, is indicated by its official designation: Civil War Campaign, Indian Campaign, Spanish Campaign, Spanish War Service, Army of Cuban Occupation, Army of Porto Rican Occupation, Philippine Campaign, Philippine Congressional, China Campaign, Army of Cuban Pacification, Mexican Service, Mexican Border Service and Victory Medal.

A decoration constitutes part of the uniform of the individual officer or enlisted man to whom it has been awarded, as does also a service medal.

E. A. K.

NAVY

The Navy and Marine Corps decorations are as follows: Medal of Honor—Act of Congress, Dec. 21, 1861, Mar. 3, 1921; Distinguished Service Medal—Act of Feb. 4, 1919; Navy Cross—Act of Feb. 4, 1919; Distinguished Flying Cross—Act of July 2, 1926; Serv-

ice Medal—Battle of Manila Bay, June 3, 1898 and Naval Engagements in West Indies—Act of Mar. 3, 1901; Specially Meritorious Medal—Act of Mar. 3, 1901; Civil War Campaign Medal; Spanish Campaign Medal; Philippine Campaign Medal; China Campaign Medal; Cuban Pacification Medal; Mexican Service Medal; Nicaraguan Campaign Medal; Haiti Campaign Medal; Dominican Campaign Medal; Victory Medal (World War Service Medal); The Maltese Cross and the following additional medals: Haiti Campaign Medal, 1919-20; Second Nicaraguan Medal; Yangtze Campaign Medal; Marine Corps Expeditionary Medal.

Clasps are awarded in 19 separate instances to commemorate certain service, i.e., Transport; Escort; Armed Guard; Grand Fleet; Patrol; Submarine; Destroyer; Aviation; Naval Battery; White Sea; Asiatic; Mine Laying; Mine Sweeping; Salvage; Atlantic Fleet; Overseas; Mobile Base; Submarine Chaser; West Indies.

R. E. C.

BIBLIOGRAPHY.—*American Decorations*, War Department, Document No. 18a, 1927.

DE COSTA, BENJAMIN FRANKLIN (1831-1904), American clergyman and historian, was born at Charlestown, Mass., on July 10, 1831. Graduating from the Biblical Institute at Concord, N.H., in 1856, he entered the Episcopal ministry, and from 1857 to 1860 was rector at North Adams and Newton Lower Falls, both in Massachusetts. During the first two years of the Civil War he was chaplain for the troops of his state, and was war correspondent for the *Charlestown Advertiser*. From 1864 to 1867 he was editor of the *Christian Times* and the *Episcopalian*. About this time his historical work began in earnest, De Costa collecting bits of information in his extensive travels after 1873. In 1881 he became rector of the church of St. John the Evangelist in New York, and while in this position led the opposition to the ordination of Prof. C. A. Briggs as a priest in the Episcopalian church. When Briggs was ordained in 1899, De Costa resigned, and became a Roman Catholic. He was ordained a priest in 1903 in Italy. He died on Nov. 4, 1904. His most important historical work was *Pre-Columbian Discovery of America by the Northmen*, 1868. He founded the first American chapter of the White Cross, was a member of the Knights of Labor, and helped to organize the Church Temperance Society.

DE COSTER, CHARLES T. H. (1827-79), Belgian writer, was born at Munich, Bavaria, Aug. 20, 1827. After being employed in the Royal Archives, he became Professor of Literature in the Military School at Brussels. He made a profound study of the French language throughout the ages, and wrote his *Flemish Legends* in the French of the 16th century; it is a picturesque work, wonderfully documented. Neglected for a long period, he is now recognized as a masterly prose writer. De Coster died at Ixelles, May 7, 1879.

DECREE, in English jurisprudence is an order in equity law that must be obeyed directly by the party

to whom it is addressed, under penalty of imprisonment for CONTEMPT OF COURT. A decree differs from a judgment-in-common-law in that it is not left to the sheriff to execute. It is *in personam* rather than *in rem*. Furthermore, a decree may prescribe more comprehensive remedies than the mere restitution granted under the common law. A *decree nisi* is a conditional grant of divorce by a court, made final after six months if no unforeseen obstacles arise.

BIBLIOGRAPHY.—E. Jenks, *The Book of English Law*, 1929.

DECREPITATION, roasting a substance, as a salt in a strong heat, to reduce it to powder; also the snapping or bursting with crackling noise on being heated. This snapping and crackling is produced by the unequal expansion of the substance on heating or by the expansion and volatilization of liquid held mechanically within its particles.

DECURY (*decuria*), an ancient Roman word used of a group of ten men; e.g., a division of the early tribes, the parts of Romulus's senate, the parts of the legion, the panel of judges, whose composition as to social class, number and proportion changed under the various emperors; and groups in the municipal senates.

DEDHAM, a town and the county seat of Norfolk County, eastern Massachusetts, located on the Charles River 10 mi. southwest of Boston. It is served by the New York, New Haven & Hartford Railroad. It is primarily a residential community, but has cotton and woolen manufactures. In 1929 the retail trade amounted to \$3,686,682. Dedham was established in 1636. Pop. 1920, 10,792; 1930, 15,136.

DEDUCTION, a form of reasoning which proceeds from the universal to the particular, the opposite of induction. Deduction starts with universal principles, from which it establishes the truth of more specific ones. If the reasoning is correct the truth of the conclusion will depend on the validity of the basic propositions. Almost anything can be proved by deduction if the original premise be accepted. It would be comparatively easy to show that John is a good boy because all boys are good, and John is a boy; but the truth of this proposition would depend on whether or not all boys were good.

The principles of deduction were worked out by ARISTOTLE as rules of the SYLLOGISM, the form which in his view deductive reasoning takes. The method of deduction reached its height with the development of SCHOLASTICISM. With the development of induction it took a secondary place.

DEED, at COMMON LAW a written instrument under seal. Now used to mean instruments conveying PROPERTY. At the present time, a deed conveys any property that can be legally transferred. It must be free from FRAUD and executed by and delivered to persons deemed legally capable. In other words, the parties must be of age, of sound mind, and not otherwise excluded from participating in the transaction. The requirements as to the number of witnesses, seals, etc., vary according to locality. Generally speaking, deeds are construed in favor of their validity.

DEEP-SEA FISHING, a sport which is becoming more and more popular, especially along the eastern coast of the United States. Scores of boats put out from New York, Boston and other Atlantic ports, carrying from 10 to 50 fishermen; and from Maine to Florida, smaller parties seek nearby fishing grounds to fish for everything from the pollock, cod, porgie and flounder of northern waters to the gray mullet and red snapper of more southern waters.

To the fisherman who seeks sport rather than quantity, seabass, tautog or blackfish, kingfish and weakfish are the favorites. Since the depth of water is often great and the drag of current and tide to be considered, heavy tackle weighted with several ounces of lead is required. Most deep-sea fishing is bottom fishing or within a few feet of the bottom. Shrimps, clams, bread pellet and sandworms are the best baits, though finest of all is a strip of freshly caught squid. Fish are often brought to the vicinity of the boat by chumming, or sprinkling the water with finely chopped squid, clams or shrimps. See ANGLING; TARPON FISHING; TUNA FISHING; SAILFISH FISHING.

See Charles F. Holder, *Salt Water Game Fishing*, Outing Handbook 39, 1914.

DEEP-SEA LIFE, often called pelagic life, although the latter is, strictly speaking, any type of life existing in the oceans. It is characterized and dominated by the peculiar conditions prevailing at great ocean depths. Chief among these are the tremendous pressure of the water, the absence of daylight, and the practically constant low temperature. The pressure increases downward by about a ton per square inch for every mile of depth, amounting to six tons per square inch at the greatest known ocean depth of 5269 fathoms. To compensate for this all deep-sea animals are comparatively soft, and are filled with fluids which balance this enormous pressure. One inevitable consequence of this is, however, that when they are brought to the surface the sudden decrease in pressure kills them, sometimes even making them explode and throw out their intestines. The temperature at great depths is usually around 34° F., and sunlight practically ceases to penetrate below 200 fathoms.

Many of the deep-sea animals carry phosphorescent apparatus and it is probable that this is of much use in hunting for their prey. In addition their sense of touch seems to be highly developed. The majority have big heads, strongly developed jaws and enormous teeth. Fishes living near the bottom generally have small eyes, while some are entirely blind; those in intermediate depths often have very large eyes. Many are brilliantly colored, but, as one might expect under the feeble illumination existing there, the intensity of color is more important than the design, which often consists simply of large patches of red, green and yellow, with a characteristic absence of blue. But it should be remembered that the colors as they actually appear under the phosphorescent light at great depths may be entirely different from those observed by us.

The complete absence of daylight in the abysmal regions makes it impossible for any plant life to exist, since this depends for its food on the PHOTOSYNTHESIS of carbohydrates from carbon dioxide and water. The abyssal fishes probably obtain the oxygen necessary for their respiratory processes from the air dissolved by the cold polar water which is slowly brought down to the ocean floor. For their food supply they probably subsist on the organic material which drops down from the surface regions of the oceans, and settles on the bottom in the form of ooze. The larger animals live by devouring the smaller ones.

Knowledge concerning deep-sea life is still somewhat scant, depending entirely upon information obtained from soundings and dredgings, notably those of the CHALLENGER EXPEDITION, the explorations of the Prince of Monaco, and those executed by the U.S. Hydrographic Survey. The apparatus in use at present does not allow animals larger than 4-5 feet in size to be hauled in, and consequently all information concerning possible larger abyssal fauna is completely lacking. W.J.L.

DEEP-WELL PUMPS, mechanisms used to deliver water from a well to the surface. These may be either of the centrifugal, reciprocating (suction or plunger) or screw types. The latter is the most recent development. It has as its impeller element a screw or series of screws (resembling the screw propeller of a ship) mounted on a long, vertical, steel shaft. Both the centrifugal and the screw deep-well pumps have the advantage of continuous, non-pulsating flow, but the latter usually has the larger capacity. *See also* PUMPS.

DEER, a ruminant mammal of the subfamily (*Cervinae*). Deer are most sharply distinguished from all members of the ox group *Bovidae*, by the fact, first, that the horns of the males (bucks, stags) are composed of true bone, and second, by the fact that these are annually shed and replaced. In all *Bovidae*, such as cattle, goats, antelopes, sheep, the horns are permanent sheaths of horny material covering bone cores. The crown of a deer's skull bears two blunt protuberances or pedicels. When a male fawn approaches maturity, there grows on each of these, beneath a velvety skin, an extension which slowly takes the shape of a spike; this spike-like growth is filled with blood-vessels charged with lime that gradually fills the substance, converting it into almost solid bone. When this process is completed, the dried outer skin or velvet peels off and the year-old young deer carries strong and sharp horns, his weapons. They last until late winter, then loosen from the pedicels and fall off. In the next spring the process is repeated; new horns arise in the same way, and are again lost, and this is repeated year after year. Many species never produce more than a spike; but in most of them the horns put out branches (tines), adding about one annually up to the number belonging to that kind of deer. The branched horns are then called a pair of antlers, useful weapons against wolves and other enemies, although striking with the front hoofs is the

deer's customary way of beating off an attack. Antlers serve mainly at mating-time in fights with rivals to the affection of does, for deer are polygamous, and seek to possess several mates. One or two fawns only are produced annually.

Deer form a very large and greatly varied tribe, and exist in all parts of the world except in Africa, Australia, and most oceanic islands. They are dwellers in mountains and forests rather than open plains, are browsers more than grazers, agile jumpers rather than runners. The species, belonging to several genera, vary in size, from the great stags of the north to the smaller tropical forms and the tiny deerlets of India, and in antlers from the wide-branching weighty crown of the elk to minute spikes. The coat is always short and wiry, in most cases uniformly colored from yellowish to deep brown and when marked at all only in series of whitish spots which in most cases appear only in fawns, disappearing with age. The vast usefulness and importance as food (venison) of this class of animals needs no description. E.I.

DEER, AMERICAN.

The deer in North America consist of the Moose, CARIBOU, and WAPITI, also of several species of the native genus *Odocoileus*. The common species in the United States and southern Canada is the Virginia deer, suitably called whitetail particularly in the West. This is a forest-border deer of fairly solitary habits, feeding chiefly on the leaves, twigs and tender bark of trees, but in summer delighting in the vegetation growing in and about rivers and swamps, and in cultivated regions profiting by nocturnal visits to the farmer's crops and haystacks. It is still numerous in most of the eastern states and in southern Canada, and is protected by conservation laws. This deer does not gather into herds, nor wander widely, but is met with in family parties. Two fawns are usually produced annually. Their first coats are marked with white spots, as also are the fawns of our other deer. In the West it avoids the prairies, preferring brushy river courses, and in places is called willow deer. This graceful animal, the buck standing 36-40 in. at the shoulder, has the back and flanks reddish (gray in winter) and the belly white. The lower surface of the well-feathered tail is pure white, making it very conspicuous when lifted, as in excitement of flight. The bucks acquire annually a fine crown of forward-pointing antlers, and shed them every spring.

The mule deer, noted for its long ears, is a slightly larger species inhabiting the Rocky Mountain region.



AXIS DEER, OR CHEETAL, OF INDIA

Its coat has a tawny hue, and its breast is darker than its back, with the throat and buttocks pale; the tail is white with a black tip. The antlers are rather erect and their tines fork. Once exceedingly common between the Missouri River and the Sierra Nevada it is now becoming rare and shy, except in certain regions, as the Kaibab Plateau, Ariz., where it is abundant. The strange jumping gait of its swift speed, and its ability in climbing mountains, are characteristics.

The Columbian blacktail, of the Pacific coastal slope, differs from the mule deer in being more reddish, and in having less white about the blackish tail.

E. I.

DEERFIELD MASSACRE, Feb. 28, 1704, a surprise attack on New England colonists in QUEEN ANNE'S WAR. Hertel de Rouville, who had commanded raiding parties against the New England frontier settlements during KING WILLIAM'S WAR, led a force of about 200 Indians and 50 Canadians against the Massachusetts hamlet of Deerfield. The expedition, traversing 300 miles of snowbound wilderness on snowshoes, was entirely unexpected, and captured the village with ease. Forty-nine inhabitants were murdered, and 111 carried into captivity. John Williams, the first minister of Deerfield, was among those carried off to Canada.

DEER-FLY, a popular name for various species of gad-flies (*Tabanidae*). The females suck the blood of

DEER-WEED (*Lotus scoparius*), a half-erect, bushy perennial of the pea family abundant in hilly districts in California. It grows from 1 to 4 ft. high with long, slender greenish branches bearing small pinnate leaves of 3 to 5 leaflets and numerous umbels of small, somewhat clover-like, yellow flowers marked with reddish purple.

DE FACTO GOVERNMENT, government set up in opposition to the DE JURE or titular government, seeking either to wrest control from the latter or to secede from its jurisdiction and authority. De facto governments became the test of the American recognition policy, the first statement of which was made by THOMAS JEFFERSON as Secretary of State: "It accords with our principles to acknowledge any government to be rightful which is formed by the will of the nation, substantially declared." The test of de factoism continued to be the American policy in recognizing new governments until President Woodrow Wilson declared that governments which were "legal" and "constitutional" would be recognized by him. Secretary of State Stimson has recently officially abandoned this policy in the United States except for the Central American republics which have adopted this principle by treaty and has reaffirmed the original text of de factoism.

DEFAMATION, the injury to a person's character or reputation by false statements. Defamation includes both libel (written defamation), and slander (oral defamation). Libel is punishable criminally, and both libel and slander give rise to a civil liability for damages.

DEFAULT, failure to perform some duty. In legal procedure the term is used with reference to failure to a party to appear when required, or to plead within the time allowed him.

DEFECTIVE CLASSES, EDUCATION OF. There are three classes of physical or mental defectives which require special methods of instruction and in large measure schools especially designed for their needs: the deaf, the blind, and the mentally defective, the latter called subnormal or feeble-minded. The deaf and blind were the first groups in the United States for which schools were provided (*see* DEAF, EDUCATION OF; BLIND, CARE AND EDUCATION OF), and these proved so successful that attention was turned to the education of the mentally defective. (*See* MENTAL DEFICIENTS, EDUCATION OF.) The early work in educating all three groups was based largely on the methods of instruction used in Europe, but developed along different lines. The blind and deaf have, through the educational efforts made in their behalf and their own renewed hopes, been able to complete not only elementary and secondary schooling, but in many cases to continue through college, and to do so with averages equalling those of normal students. Though attempts were made to educate mental defectives in much the same manner as the deaf and blind, it was soon found that this was impossible. The aim was then modified so as to train the mentally deficient to become self-supporting and



FROM JEPSON MAN. PL. PLANTS CALIF. COPYRIGHT

DEER-WEED

Flower, pod and flowering branchlet

various animals, even man. The males live on flower nectar. The eggs are laid in moist places and water where the larvæ prey upon smaller animal life. Apparently they reach maturity in the fall but postpone pupation until spring. The females are powerful and swifter than horses.

responsible citizens in their communities. In addition to the private institutions for the defective groups, schools are maintained by the individual states, and special classes are provided in many of the public school systems for their individual instruction. In 1927-28 there were 104,021 students in schools in the United States for the feeble-minded and sub-normal. M. R.

DEFENDANT, the party in a legal action or proceeding against whom the charge or claim is made. In a civil suit the defendant answers by denying allegations made against him or by admitting the allegations but asserting that, granting them, there is no cause of Action against him. The PLAINTIFF is required to establish his case by a preponderance of evidence. In a criminal case, the evidence against the defendant must establish the charge beyond a reasonable doubt. See also BILL OF PARTICULARS.

DEFERRED ASSETS, a term applied in business to such items as organization expenses, BOND DISCOUNTS, extraordinary expenses such as advertising campaign costs, the benefits of which will probably accrue to future periods, as well as the current and fire and earthquake losses not possible of absorption within the current period. The title is sometimes expanded to deferred charges to operations and may even include prepaid expenses. Where both terms are used, prepaid expenses is limited to the regular normal operating expenses paid for in advance. See also ASSETS AND CURRENT ASSETS.

DEFFAND, MARIE ANNE DE VICHY-CHAMROND, Marquise du (1697-1780), French social leader, was born at the Château de Chamrond in 1697. At an early age she was married to the Marquis du Deffand but separated in 1722. Remarkably witty and intelligent, her salon in Paris became the meeting place of many of the most illustrious men in Europe. She corresponded with VOLTAIRE and Horace WALPOLE, and her letters to Walpole were published in 1810. She died in Paris, Sept., 1780.

DEFIANCE, a city in northwestern Ohio, the county seat of Defiance Co., situated on the Maumee and the Auglaize rivers, 60 mi. southwest of Toledo. It is served by bus lines, airplanes and two railroads. Defiance is in the corn-growing belt of Ohio, and is an industrial center, making automobile parts, steel barrels and machinery. It is the seat of Defiance College. Ft. Defiance was built by Gen. Anthony Wayne, and Ft. Winchester by Gen. Harrison, afterwards President of the United States. Defiance was incorporated in 1836. Pop. 1920, 8,876; 1930, 8,818.

DEFICIENT NUMBER, a number that is greater than the sum of its ALIQUOT PARTS. For example, $8 > 1 + 2 + 4$ and hence 8 is a deficient number. In general a number is said to be deficient, perfect or abundant according as it is greater than, equal to, or less than the sum of its aliquot parts. See PERFECT NUMBER; NUMBER THEORY; ABUNDANT NUMBER.

DEFINITION, a logical function by which meanings are made more clear. In formal logic it takes

the form of throwing the thing to be defined into the next including genus, and then differentiating it from other species within the same genus. It is placed in a larger class and given characteristic marks which set it off from other objects in this class. Aristotle's famous definition of man illustrates this procedure. Man is a rational animal. Man, the thing to be defined, is a species of animal, a higher class or genus, and rationality is the specific attribute which differentiates man from other animals.

This formal procedure assumes that things can be defined according to their inherent attributes, regardless of the purpose of the definition. It is rigorous in its method and exacting in thought, but it may sacrifice truth by neglecting the variability of definitions with the purpose expressed in them.

DEFLAGRATION, a term applied to burning or combustion and especially of the rapid oxidation of a substance accompanied by sudden evolution of flame. It can be produced chemically by the mixing of a combustible substance with potassium chlorate or niter in small amounts and heating, or electrically by a spark.

DEFLATION. See INFLATION AND DEFLATION.

DEFOE, DANIEL (c. 1660-1731), English writer, was born in London about 1660, the son of James Foe, a butcher. He received a good early education at the Stoke Newington Academy. He went into business in 1685, and in 1688 served with the army of King William III. He became bankrupt in 1692, but later paid his debts. About 1695 he was appointed accountant to the commissioners of the glass duty, a post he held till 1699. In 1703 Defoe published his ironical treatise, *The Shortest Way With the Dissenters*, for which he was fined, pilloried and imprisoned about a year. He wrote constantly while in prison, and after his release became a conspicuous political intriguer in London. He began his famous paper, *The Review*, in 1704, continuing it until 1713. He published a prodigious number of political pamphlets, and was frequently in difficulties because of his stand on political and religious questions. A born journalist, he had a great gift for reaching the common people. In 1715 Defoe issued an apology for his political career entitled *An Appeal to Honour and Justice*. From that date until his death he wrote a great body of fiction, his best known works being ROBINSON CRUSOE, 1719, and *Moll Flanders*, 1722. Other well known novels are *The Life and Adventures of Mr. Duncan Campbell*, 1720, *Memoirs of a Cavalier*, 1720, *Captain Singleton*, 1720, *The Journal of the Plague Year*, 1722, *The History of Captain Jack*, 1722, and *Roxana*, 1724. Defoe has been called the first of the realists, and his novels are indeed packed with realistic incidents and descriptions. He died in London, Apr. 26, 1731. See also ENGLISH LITERATURE.

BIBLIOGRAPHY.—William Minto, *Daniel Defoe*, 1885; W. P. Trent, *Daniel Defoe, How To Know Him*, 1916.

DE FOREST, LEE (1873-), American inventor and radio engineer, was born Aug. 26, 1873, at Council Bluffs, Ia. He was a pioneer in the development

of wireless telegraphy, in which field he began researches following studies at the Sheffield Scientific School (Yale). The use of alternating current generator and transmitter, now generally employed in wireless transmission is the result of his experimental work. After organizing the American De Forest Wireless Telegraph Co. he devoted his efforts to radio, forming the De Forest Radio Telephone and Telegraph Co. More than two hundred patents protect his work on radio telegraphy and telephony, chief among which are those covering the "Audion," a detector, amplifier, and oscillator, by which transcontinental and transoceanic telephone communication, by wire and wireless, was made practicable; and the three-electrode and the four-electrode tube. De Forest designed and constructed the first five high-powered radio stations for the U.S. Navy. Medals of the Franklin Institute and the Institute of Radio Engineers, and membership in the Legion of Honor are among the honors bestowed on him.

DEFORMATION, ARTIFICIAL, in anthropology, the practice of consciously and permanently modifying a part of the body by artificial means. The usual motive is the enhancement of personal beauty, but other reasons are sometimes operative. One of the commonest expressions of this custom is the artificial deformation of the skull. It is worldwide in distribution but especially characteristic of the Flat-head Indians of the Northwest, the Pueblo Indians of the Southwest and the Indians of Peru. There are a number of ways of securing the desired head-shape. Ordinarily the head of the infant is kept bound with bandages and even by splints in some cases until the deformation is permanently fixed.

Other common forms of artificial deformation are the enlargement of the ear lobe, the lip or the nasal septum. The simple piercing of the ear lobe as practiced in Europe can hardly be called a deformation.

Artificial deformations are not confined to primitive peoples. Formerly Chinese women of the upper classes took pride in their deformed feet, the arches of which were broken in infancy and bound, thus achieving small but crippled feet. Some primitive people lacerate their bodies in an effort to achieve beauty.

H. L. S.

DEGAS, HILAIRE GERMAIN EDGAR (1834-1917), French painter and pastellist, was born at Paris, July 19, 1834. His early work shows the influence of his teacher, Ingres, but in 1874 he allied himself with the Impressionist School. In 1868 Degas began the studies of ballet girls for which he is best known. At the Impressionist Exhibition of 1886 he showed canvases of milliners, washerwomen, jockeys and dancers in which the primary interest was the pattern. Although classed as an impressionist, Degas' chief concern was with linear problems, rather than those of light. He was a superb draughtsman and designer and all his work bears the mark of a sensitive personality. Degas died at Paris, Sept. 27, 1917.

DEGREE, a unit used in general of one of a series of equal steps or graduations. In angular measure, it

is $1/360$ of a circle or $1/90$ of a right angle, or quadrant; in temperature measurement, it is $1/180$ of the temperature difference between the freezing and boiling points of water on the Fahrenheit scale and $1/100$ of that difference on the centigrade scale; in education, the academic rank conferred upon a graduate by a diploma; in grammar, one of the three steps in the comparison of adjectives or adverbs; in music, the interval between succeeding notes; in mathematics, a classification of equations according to exponents or sums of exponents, equations taking their rank from the term of the highest degree, e.g., the third-degree equations, $x^3 + y = 0$ and $x^2y + 2x = 0$.

DEGREES, EDUCATIONAL AND HONORARY, are conferred by universities and colleges upon completion of prescribed courses or in recognition of distinction in literature, science or civic leadership. In the United States there are over 200 degrees granted. The bachelor's degree in arts, sciences, philosophy or letters is usually conferred on completion of four years of study in one of those branches. The master's degree is usually granted for one year's graduate study in arts or sciences, and the doctor's degree upon completion of approximately three years of graduate work and a thesis on a subject approved by the faculty, which shall represent original work or research in the field in which the student is specializing. The honorary degrees, such as Doctor of Laws, Doctor of Science or Doctor of Letters, are conferred solely in recognition of special achievement or distinction and do not require university attendance. In France, the usual degrees, the *licence* and *doctorat*, are State degrees. The *doctorat d'université* is now added, signifying recognition from the university. The *baccalauréat* is granted in the faculty of law. In England the first degrees are usually the Bachelor of Arts or Science, though there has recently been a tendency to make further designation of the faculty in which the degree is received, as Bachelor of Commerce or Bachelor of Architecture. The master's degree is granted on examinations at all the universities except Oxford and Cambridge, being given here after a required period of residence. The doctor's degree is granted in the faculties of science, literature and laws on completion of designated requirements; the doctor's degree in letters, law and sciences, in recognition of some contribution to or distinction in some special field.

DEHYDRATION: Industrial Applications.

In chemical operations, crystals and precipitates, after preliminary filter pressing or centrifuging, are spread in trays and dehydrated in chambers or tunnels heated by flue gases, steam or air. Frequently the process is made continuous, the heated air being circulated in a direction opposite to the movement of the trays. Fruits, vegetables and similar products are dried in this manner. Liquids, such as milk and fruit juices, are dried by atomizing them into a current of washed, heated air, they often being previously concentrated in an evaporator. (See EVAPORATION AND EVAPORATORS.) The solids collect on the floor and walls of

the drying chamber and the moisture-laden air passes through a collector for the removal of the lighter particles. Alternatively, the liquid may flow onto heated metal rolls, sometimes enclosed in a vacuum chamber, from which the water rapidly evaporates, to leave a thin film which is removed with a knife edge. Gases are dehydrated by passing them through towers or tubes packed with calcium chloride, phosphoric anhydride, soda lime or other suitable absorbent. *See also* DESICCATION: DRYING AND DRYING EQUIPMENT; DRYERS, WOOD PRODUCT. J. H. N.

DEHYDRATORS, devices for removing moisture from materials. As a means of preservation, or to render some agricultural products suitable for human consumption, the material must be reduced to a water-free basis. If the material is subject to injury from high temperatures a vacuum process is usually employed; otherwise, dehydration may be accomplished in an oven or kiln at or above the temperature of boiling water.

DEHYDROGENATION, the removal of hydrogen from a chemical compound of which it is a part. It is accomplished by placing, in contact with the compound containing the hydrogen, a substance possessing a great affinity for it. Oxygen is frequently used and the reaction may be often facilitated by heating.

DEIANEIRA, in Greek mythology, daughter of Althaea and Oeneus, and sister of Meleager. She was the wife of HERCULES, whose death she unwittingly caused. In despair Deianeira killed herself.

DEIPHOBUS, in Greek mythology, son of PRIAM and HECUBA. He was next to HECTOR in importance in the Trojan War and took command after Hector's death. He helped to slay ACHILLES. When PARIS was killed Deiphobus married Helen (*see* HELEN OF TROY), but was betrayed by her to MENELAUS who slew him.

DEIRA, a kingdom comprising a territory in England extending from the Humber River to the Tyne and constituting the southern portion of what after 633 was known as Northumbria. The first recorded king of Deira was Ella who reigned in the last quarter of the 6th century. His son Edwin ruled over both Deira and Bernicia, and thereafter the two kingdoms were historically united as the kingdom of NORTHUMBRIA.

DEISM. In the 16th century the word deist, as the opposite of atheist (*see* ATHEISM), was used to designate anyone who believed in a divinity. In the 17th century, however, the term Deism meant the system that teaches as first cause of all things a God who is not merely transcendent, as opposed to PANTHEISM, but assumes, as opposed to THEISM, that he is aloof from the world, incomprehensible, and does not reveal himself. Charles Blount (d. 1693) was one of the first to call himself a deist in this sense, and he ridiculed Biblical history in an ironic manner. Tindal and Morgan were his foremost successors. Their thinking was influenced by the ecclesiastical-political confusion in the 17th century and by a

theology antiquated in comparison with the progress of science. The actual founder of this form of Deism was Edward Herbert, who was the first to develop the conception of the sufficiency of natural religion. Such attacks became more comprehensive and bitter after the introduction of freedom of the press in 1694 and after the appearance of John Locke's (*see* LOCKE, JOHN) work *The Reasonableness of Christianity* in 1695. After that Christianity was frequently attacked as priestcraft and robbed of its historic significance and basis. Shaftesbury advocated a religion of beauty and virtue in this world and attacked Christianity as immoral on account of the idea of eternal vengeance. John Toland, the first to be called a freethinker, Collins and others attempted to remove the supernatural from religion and to establish the right of free thinking as one of the rights of man. Tindal denied the idea and possibility of revelation in his *Christianity as Old as the Creation*, the chief tract of Deism. Bolingbroke considered religion as a tool for political purposes and free thinking as for the higher classes only. With DAVID HUME Deism became SCEPTICISM. In France the negative tendency of Deism was increased, and in Germany it led towards criticism of the Gospels and theological rationalism.

DE JURE GOVERNMENT, titular or legal government of a state, which has succeeded to power in keeping with the provisions of the fundamental law of the state. A *DE FACTO* government, recognized as *de jure*, is, as regards the recognizing state, invested with legality, without regard to its origin or previous revolutionary character. The *de jure* test of recognition was collectively urged by the members of the HOLY ALLIANCE in 1815, who were committed to the principle of legitimacy, or the rights of succession of reigning monarchs. It followed that they were the enemies of revolutionary movements, and therefore enemies of *de facto* governments. It was against this avowal of policy that the MONROE DOCTRINE was directed.

DE KALB, JOHANN, BARON (1721-80), American soldier, born near Bayreuth, Bavaria, on June 29, 1721, the son of peasants. In 1743 he served in a German regiment in French employ, and in the French armies during the War of the Austrian Succession and the Seven Years' War. Upon his arrival with Lafayette in America in July, 1777, he was commissioned a major-general in the Colonial army. He served in the field in New Jersey and Maryland, and developed an intense loyalty to Washington, who appointed him an officer in the army of the South, giving him rank next to the commander-in-chief, Horatio Gates. At the battle of Camden on Aug. 16, 1780, when Gates deserted his command, De Kalb continued the fight until he was wounded and taken prisoner. He died three days later at Camden.

DE KALB, a city in northeastern Illinois, in De Kalb Co., on the Kishwaukee River, 60 mi. west of Chicago. Bus lines and three railroads afford transportation. De Kalb is an important industrial center,

manufacturing barb-wire and other wire products, pianos, refrigerating plants, roller skates, wagons and truck bodies. The city has also furnace foundries, vegetable canneries and creameries. It is the seat of the Northern Illinois State Teachers College. The surrounding region is fertile country, producing grain and live stock. The city was founded about 1835 and was known as Buena Vista until 1840. De Kalb was incorporated in 1856. Pop. 1920, 7,871; 1930, 8,545.

DEKKER, EDUARD DOUWES (1820-87), Dutch novelist, was born in Amsterdam, Mar. 2, 1820. He wrote and became famous under the pseudonym "Multauli." The book that established his fame is an autobiographical account of his brief service as a government official in the Dutch East Indies. This sensational work of fiction is entitled *Max Havelaar*, 1860, and constitutes an indictment of the injustice and scandals in the Dutch administration of Java. Among the novelist's other works are *Parables*, a novel called *The Blessed Virgin*, and *The School of Princes*, 1878, his best play. Dekker died at Niederlingelheim, Feb. 19, 1887.

DEKKER, JEREMIAS DE (1609-66), Dutch poet, was born at Dordrecht in 1609. His early intellectual promise was reinforced by a severe classical training. His first verse, including the *Lamentations of Jeremiah*, imitated JUVENAL, HORACE, and other Latin poets. These were followed by lyrics, epigrams and other productions that can bear comparison with the best of his generation. Dekker's work gave great intellectual impetus to the Dutch language and some of his poems are still read with enjoyment to-day. The poet died obscurely in Dec. 1666.

DEKKER or DECKER, THOMAS (1572-1632), English dramatist, was born in London, 1572. In *The Poetaster*, BEN JONSON refers to Dekker as a dresser of plays, and he is said to have collaborated in writing more than forty plays. Some of those preserved are *Old Fortunatus*, played Dec. 27, 1599; *The Shoemaker's Holiday*, about 1599; *Satiromastix*, 1601; *The Honest Whore*, 1604; *Westward Ho*, 1604; *If it be not Good the Devil is in It*, 1610; *Match Me in London*, and *The Noble Soldier*, probably his last. Dekker also wrote some popular pamphlets, including *The Gull's Hornbook*, a vivid picture of a London fop's life; and *The Wonderful Year*, a description of London during the great plague. He also wrote lyrics, including the well-known *Art thou poor*. He was probably the Thomas Decker who was buried Aug. 25, 1632.

DEKOVEN, REGINALD (1859-1920), American composer, was born at Middletown, Conn., Apr. 18, 1859. He studied composition, piano and singing in Paris, Vienna, and Florence. His first comic-opera, *The Begum*, was produced in 1887 at Chicago, where also appeared in 1890 his *Robin Hood*, most successful of his 41 light operas. His songs include *O, Promise Me*. He died at Chicago, Jan. 16, 1920.

DELACROIX, FERDINAND VICTOR EUGÈNE (1798-1863), French painter, was born at

Charenton-Saint-Maurice, near Paris, Apr. 26, 1798. He was much influenced by the works of Veronese and Rubens. After seeing a landscape by Constable, he began to paint with divided tones, choosing episodes from contemporary history or passages from the works of Byron for subject matter. Considered a revolutionary, Delacroix became the leader of the romantic movement in painting. His *Massacre of Chios*, noted for its green flesh tints and violent reds, was called by Gros "the massacre of painting." A trip to Morocco in 1832 resulted in many bright water color sketches of Arab horsemen and wild beasts, which are to-day preferred to the huge canvases in oil. An even greater contribution to the history of painting are the black and white drawings and the *Journals*, in which Delacroix set down the credo that "gray is the enemy of all painting." The painter died at Champrosay, near Paris, Aug. 13, 1863.

DELAGOA BAY, a spacious inlet of the Indian Ocean on the coast of Portuguese East Africa, affording an excellent natural harbor which is separated from the outer bay, about 25 mi. long and 20 mi. wide, by a bar about half a mile broad. The harbor is available for vessels of large tonnage, though the presence of shoals, banks and flats in the bay formerly rendered navigation somewhat difficult. The port, Lourenco Marques, is being constantly developed as a place of trade; a railway runs from it to Pretoria, 200 mi. distant.

DE LA MARE, WALTER (1873-), English poet, was born at Charlton, Kent, Apr. 25, 1873. He was educated at St. Paul's Cathedral School, London. From 1889-1908 he was employed by an oil company; but a grant from the Privy Purse enabled him thereafter to devote his time to writing. His published works include the noted *Peacock Pie*, 1913; *Collected Poems*, 1920; *Memoirs of a Midget*, a novel, 1921; *The Connoisseur and Other Stories*, 1926; *Stuff and Nonsense*, 1927, and *On the Edge*, tales of the occult, 1931. An extremely able technician, De La Mare is noted for his experiments with new and unusual meters.

DELAND, MRS. MARGARETTA WADE (1857-), American novelist, was born at Allegheny, Pa., Feb. 23, 1857. She was educated at private schools and at Cooper Union. Her first book was *Old Garden and Other Verses*, but success came suddenly with the publication in 1888 of *John Ward, Preacher*. This dealt with social and religious problems of the day and aroused much discussion. Another novel, *Sidney*, was written; and in 1899 her character, Dr. Lavendar, was introduced in *Old Chester Tales*. Mrs. Deland's most popular novel is perhaps *The Awakening of Helena Ritchie*; among other works are *The Story of a Child* and *The Iron Woman*.

DE LAND, a city in northeastern Florida, the county seat of Volusia Co., near St. John's river, 110 mi. southeast of Jacksonville. Bus and truck lines, river craft and the Atlantic Coast Line Railroad serve the city, which is a popular winter resort. Citrus fruits, vegetables, flowers, and especially ferns, are

raised in the vicinity. The chief industry is the packing of citrus fruits; others are lumber milling, turpentine and palmetto fiber manufacture. De Land is the seat of John B. Stetson University. The city was founded in 1882 by Henry A. De Land. Ponce de Leon Springs and Blue Springs are near. A short distance from the city are the ruins of a Franciscan mission and of old Spanish sugar mills and indigo vats. Pop. 1920, 3,324; 1930, 5,246.

DELAROCHE, HIPPOLYTE or **PAUL** (1797-1856), French historical painter, was born at Paris, July 17, 1797. A mediocre artist and an unreliable historian, Delaroche's genius lay in his ability to depict melodramatically certain episodes from French and English history. He painted a series of small religious canvases, with subjects chosen from the Passion. His most important commission was the decoration of the hemicycle wall in the lecture theater of the École des Beaux-Arts. Delaroche died at Paris, Nov. 4, 1856.

DELAWARE, the most important group of federated tribes speaking dialects of the North American Indian Algonkian stock. They were also known as Lenape or Leni-Lenape. Their territory comprised the valley of the Delaware River in eastern Pennsylvania and southeastern New York, as well as most of New Jersey and Delaware. Three tribes, the Munsee, Unami and Unalachtigo, speaking distinct dialects, comprised the Delaware group. The famous Walam Olum is a recital of their traditional history. They were conquered by the Iroquois early in the 18th century and pressure from both the whites and the Iroquois forced them farther and farther westward through Pennsylvania into Ohio where they joined the Huron, became independent of the Iroquois, and strenuously fought the white invasion. Later they moved westward into Indiana, and the end of the century found them in Missouri and later in Arkansas with some Shawnee. They moved into Texas, and in 1867 were incorporated with the Cherokee in what is now Oklahoma. There are scattered survivors also among the Caddo and Wichita and in Canada under various names.



DELAWARE STATE SEAL

DELAWARE, a middle Atlantic state, one of the thirteen original states of the Union, popularly called the "Blue Hen State." It is situated between 38° 27' and 39° 50' N. lat. and 75° 2' and 75° 47' W. long. On the north it is bounded by Pennsylvania; on the east by the Delaware River and the Delaware Bay, and by the Atlantic Ocean; on the south by Maryland and on the west by Maryland and Pennsylvania. Delaware comprises an area of 2,370 sq. mi., including 405 sq. mi. of water surface. In size Delaware ranks forty-seventh among the states of the Union.

Surface Features. The surface of Delaware is nearly a dead level with a mean elevation above sea level of only 60 ft. Slight undulations in the northern part increase the altitude to 440 ft. at Centerville on the northern boundary. The southern section is sandy with large swamp tracts, and along the coast are salt marshes and shallow lagoons. A low ridge or water-parting runs north and south through the lower two-thirds of the state. Delaware has 140 mi. of tidal coast line which, toward the south, is indented by Indian River Bay and Rehoboth Bay.

Climate. By reason of its situation on the Delaware Bay, Delaware is characterized by a mild and equable climate. The annual mean temperature at Wilmington is 54.4° F., ranging from a mean of 32.8° F. for January to 76.8° F. for July, with an average annual precipitation of 44.4 in. including 22.9 in. of snow. In the spring frosts may occur as late as the latter part of April, while in the fall they seldom occur before Oct. 10, giving generally a six months growing season.

Forests and Parks. With the exception of the sand dune and salt-marsh areas bordering on the Atlantic Ocean, the tidal marshes of the Delaware River and Bay and the estuaries of the larger streams, Delaware was originally heavily forested. In the northern portion the trees were almost exclusively hardwoods, principally oak, chestnut, red gum, maple and hickory. Softwoods, chiefly eastern yellow pine, increase toward the south and the swamp area in the extreme south central portion of the state once contained a magnificent stand of cypress and cedar. But 30%, or 350,000 acres, are now forested of which 50,000 are protection forests. Practically no primitive forest areas remain. A state forest of 50 acres was set aside in 1927 along the Du Pont Highway in the southern part of the state. This forest contains a portion of the most heavily wooded tract in the state, its trees consisting of loblolly pine, scrub pine, oak, maple, sweet gum, sour gum and tulip poplar. There are no state parks in Delaware. The excellent municipal park system under the jurisdiction of the city of Wilmington includes outlying areas along Brandywine Creek extending to the Pennsylvania line and takes care of the recreational needs of the majority of the population.

Minerals and Mining. The mineral resources of the state, consisting chiefly of clay beds, sand and gravel pits and stone quarries, are of slight importance. With mineral production in 1929 amounting to \$467,493, Delaware ranked forty-eighth among the states. Of leading importance were clay products, valued at \$230,441.

Soil. The soils are the characteristic types of the Piedmont Plateau. Towards the north the yellowish clay subsoil is overlaid with a clayey loam which is excellent for such crops as grains, sweet corn and tomatoes. Growing more sandy towards the south, though still mixed with loam, the soil is better suited to truck-gardening and fruit-raising. Along the cen-

tral coast there is much swamp and marsh land which is being successfully drained. In the extreme south a grayish sand overlies the clay.

Agriculture. The chief farm products are grain, vegetables, fruits and hay.

In 1930 900,815 ac. or 71.6% of the entire land area was in farms, 9,707 in number, with an average size per farm of 92.8 ac. and an average value per acre of \$74.31. Of the farm area 504,259 ac. was crop land; 122,553 ac., pasture land; and 187,628 ac., woodland. The total value of farm property was \$83,271,797, of which \$66,941,747 was represented by land and buildings; \$7,285,130, by implements and machinery; and \$9,044,920, by domestic animals.

According to the census of 1930 Delaware produced in 1929 field crops to the value of \$15,010,134, ranking forty-fifth among the states. Of this total grain contributed \$6,021,739, vegetables \$4,443,147, fruits \$3,114,860, and hay and forage, 82,485 tons, \$1,430,388. The grains included corn, 3,466,565 bu., and wheat, 1,975,161 bu. Among the vegetables were tomatoes, \$1,370,265; sweet potatoes, \$796,074; potatoes, \$545,181; lima beans, \$251,088, and cantaloupes, \$202,395. The chief fruits were apples, 910,252 bu.; peaches, 400,937 bu., and strawberries, 8,982,938 qts. Farm machinery and equipment in 1930 included 8,724 automobiles, 2,996 motor trucks, 1,600 tractors, 513 electric motors and 1,788 stationary gas engines.

Animal Industry. Poultry, chicken eggs and milk are the chief animal products marketed. According to the census of 1930, Delaware ranked forty-seventh among the states in total value, \$9,044,920, of domestic animals on farms. Among these were cattle, 53,914, valued at \$4,205,745; horses, 17,833, \$1,691,933; mules, 9,579, \$1,147,122; swine, 30,341, \$372,644, and sheep, 5,326, \$51,573.

Of the cows on farms, 34,599 were kept mainly for milk production and 1,223, mainly for beef production. In 1929, 14,756,728 gals. of milk were produced; the value of dairy products sold amounted to \$3,134,872, including \$2,975,256 for whole milk marketed. The value of all poultry raised, chiefly chickens, was \$3,896,510; the chickens sold were valued at \$2,235,324. Of 11,200,991 doz. chicken eggs produced, valued at \$4,066,278, 9,859,015 doz., with a value of \$3,572,911, were marketed.

Fisheries. The commercial fish catch in 1930 amounted to 33,470,000 lbs., valued at \$336,000. Menhaden, shad and oysters are the most valuable species, followed by sea trout, striped bass, alewives, flounders and crabs. In 1930, 4,334 fishing licenses were issued and \$10,026 was received in fees. But \$500 was spent for fish propagation and only 17,000 game fish were planted in Delaware waters by the state. The United States Bureau of Fisheries planted 2,000 brook trout, 300 crappie, 1,111 bass and 300 sunfish.

Transportation. Delaware is favored by good transportation facilities, both by land and water. Wilmington is the center of an active coastwise trade, and is a port of entry. The Federal Government has

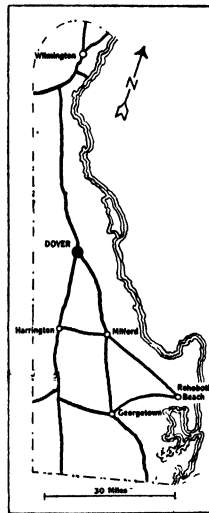
made considerable improvements there, dredging the harbor and constructing a breakwater at Lewes, which is included in the port authority. The improved docking and terminal facilities afforded by Wilmington should attract an increasing volume of ocean-going trade. A canal $1\frac{1}{2}$ mi. long crosses the northern part of the Delaware-Maryland Peninsula, connecting the Delaware River with Chesapeake Bay. The War Department has improved this to accommodate larger ships, affording a shorter waterway from Philadelphia and Wilmington to Baltimore. The Delaware & Chesapeake Canal is an important link in the coastal commerce of the Atlantic seaboard. Total railway mileage in 1930 was 325, the greater part of which is controlled by the Pennsylvania, Baltimore & Ohio and Reading systems.

The highway system shows steady improvement and extension. In 1930, there were 4,957 mi. of highways, including 1,180 mi. of surfaced roads and 756 mi. of state highways. The total highway expenditure during 1929 was \$4,410,156, of which \$2,735 was paid by the state and \$1,675,146 by county and local governments. The state gasoline tax produced a gross revenue of \$1,013,357 in 1930. Motor vehicle registrations were 56,109 in 1930 compared with 40,140 in 1925. The increase in trucking facilities is indicated by a motor truck registration of 10,576 in 1930 as against 7,590 in 1925. During the same period, the number of buses in operation increased from 146 to 211.

Manufactures. According to the Census of 1930 Delaware with manufactures for 1929 valued at \$149,642,042 stood forty-first among the states. Its 460 establishments gave employment to 3,004 officers and employees who received \$8,344,542 in salaries and to 23,552 wage earners who were paid \$29,062,739 in wages. These factories used a total of 114,961 horse power, expended \$80,490,738 for materials and supplies and added by the process of manufacture \$69,151,304 to the value of the output.

Among the principal manufactures were leather valued at \$20,613,037; foundry and machine products, \$9,982,592; pulp goods, \$8,879,793; canned and preserved fruits and vegetables, \$6,953,647; ships and boats, \$6,908,910; electric and steam-railroad cars, \$5,491,966; paper, \$4,817,327, and bread and bakery products, \$2,432,335.

Wilmington is the chief manufacturing center; its



DELAWARE STATE ROADS

factory output for 1929 was valued at \$89,607,934 or 60% of the total for the state.

Commerce. According to the census of 1930, there were in 1929 287 wholesaling establishments in Delaware, with total sales of \$236,065,985. These organizations gave full-time employment to 2,906 men and women whose annual salaries aggregated \$6,450,000. The chief wholesaling center is Wilmington.

The total sales of the 3,623 retail stores amounted to \$99,194,097. Sales per store averaged \$27,378; sales per capita were \$416.11.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
Food	1,187	\$23,331,342	23.52
Automotive	589	19,660,799	19.82
General Mdee.	333	11,121,275	11.22
Lumber & Bldg.	160	9,584,437	9.67
Apparel	224	8,560,813	8.62
Furn & Household	101	5,138,949	5.18
All other stores	1,029	21,787,482	21.97
Total, all stores	3,623	\$99,194,097	100.00

Wilmington, the principal port, handled a waterborne commerce amounting to 954,930 tons, with a value of \$72,566,673.

Finance and Banking. The assessed value of all Delaware property in 1930 was \$285,117,814. The total bonded debt was \$5,056,785, against which there were sinking funds of \$119,280. Total revenue receipts for 1930 were \$13,310,073; total expenditures \$10,735,612. The chief sources of revenue were corporation and franchise taxes and motor vehicle, gasoline and income taxes. The principal expenditures were for highways, permanent improvements and educational aid.

A state banking department was created in 1919 with a commissioner empowered to make annual examinations. In 1921 the state adopted a budget plan, which became effective in 1923. There were 62 banks in Delaware in 1930, of which 14 were national banks and 48 trust companies and state banks. Their capitalization aggregated \$13,186,928 with a surplus and undivided profits of \$31,249,000. Total resources were \$189,632,000; loans and discounts totaled \$114,557,000. Demand and time deposits, including postal savings, aggregated \$136,675,000. Per capita demand and time deposits were \$569.47; per capita savings deposits \$254.40. The total savings of \$61,056,000 were owned by 124,782 depositors. National bank circulation was \$899,000.

Government. The legislative power is vested in the general assembly composed of a senate of 17 members and a house of representatives of 35 members, the former elected for terms of four years and the latter for terms of two years. They meet in biennial sessions limited to 60 days in duration. The executive department consists of the governor, lieutenant governor, attorney-general, insurance commissioner, treasurer and auditor. The governor is elected for a term of four years but cannot be a candidate for a third time in office. His salary is \$4,000 per

year. Judiciary power is vested in a supreme court, a superior court, court of chancery, orphans' court, court of oyer and terminer, court of general sessions and a register's court. The supreme court consists of six judges chosen by the governor and legislature for terms of 12 years. The chief justice and chancellor receive salaries of \$7,500 a year, while the salaries of the other judges are \$7,200 per annum.

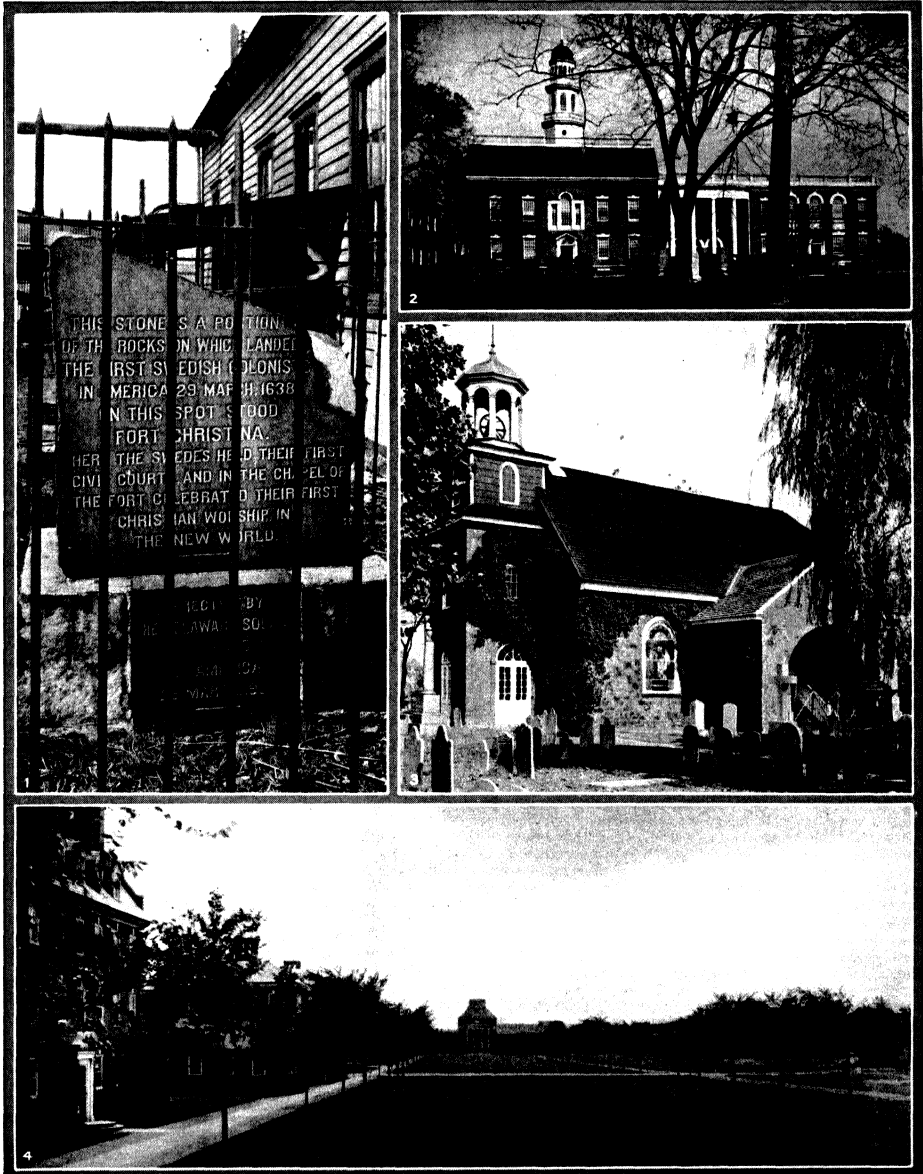
Social Welfare Institutions. The systematic supervision of charitable institutions started in 1919 with the appointment of the State Board of Charities. Certain institutions are supported entirely by the state and others partially. There is a state hospital for the insane at Farmhurst and a home for feeble-minded at Stockley. At Marshallton is an industrial school for boys and also one for colored girls. The industrial school for white girls is at Claymont. In Wilmington are a shop for the work of the blind, a home for aged colored people, a day nursery and hospital and a house of detention. The women's prison is at Greenbank. A Soldiers' Rest Room is maintained at Delaware City. The state tuberculosis sanatorium is at Marshallton. The New Castle County Workhouse about 5 mi. from Wilmington is used as a state prison as well as a city jail for Wilmington.

Education. The first schools in Delaware were founded by the Swedish colony almost immediately after it settled there in 1640. The earliest school recorded is that of New Armstel, now New Castle, taught by Ernest Pietersen in 1657. The Society of Friends established a school at Wilmington in 1765 which has been in operation continuously since. The first free school law was adopted in 1829. Separate schools for Negroes have been maintained since 1865. By 1929-30, there were 364 elementary schools with 35,899 pupils and 1,030 teachers. The 27 public high schools had 7,009 pupils and 190 teachers. Children from 7 to 14 years of age are required to attend school 5 months of the year. The number of persons from 5 to 20 years of age attending school in 1930 was 48,639, or 69.2% of the population within the ages specified, as compared to 41,081, or 64.6%, in 1920. The number of persons 10 years and over unable to read and write in 1930 was 7,805, or 4.0%, as compared to 10,508, or 5.9%, in 1920.

Institutions of higher learning are the state University of Delaware at Newark and the State College for Colored Students at Dover. The Delaware State Library Commission has its headquarters in the State Library at Dover.

Population. In 1930 Delaware ranked forty-sixth among the states with a population of 238,380, or an average of 121.3 per square mile, an increase of 15,377 or 6.9% over 1920. The population rose from 59,096 in 1790 to 91,532 in 1850, 184,735 in 1900, 202,322 in 1910, and to 223,003 in 1920. In 1930 there were 205,694 or 86.3% whites and 32,602 or 13.7% Negroes, an increase from 1920 of 6.8% whites and 7.5% Negroes. Of the whites 188,809 were native born and 16,885 foreign born. Of the total

DELAWARE



COURTESY DELAWARE STATE BOARD OF AGRICULTURE, FROM ROYDON L. HAMMOND

CHARACTERISTIC SCENES IN THE STATE OF DELAWARE

1. Monument marking the landing-place of the Swedes in 1638 on Christina Creek.
2. Delaware State House, erected in 1722.
3. Old Swedes' Church at Wilmington.
4. Campus of the University of Delaware, at Newark.

MARYLAND

Area, 12,327 sq. m.
Pop. 1,631,526

PRINCIPAL CITIES

- Pop.—Thousands**
- 13 Annapolis... 115
 - 806 Baltimore... 1414
 - 2 Bel Air... C 16
 - 2 Berlin... O 24
 - 2 Brentwood... F 11
 - 4 Brunswick... F 7
 - 9 Cambridge... L 18
 - 2 Capitol Heights... 12
 - 3 Chestertown... G 18
 - 2 Cockeysville... D 13
 - 4 Crisfield... R 20
 - 38 Cumberland... 6
 - 2 Denton... J 120
 - 4 Easton... J 18
 - 2 Elkton... C 19
 - 14 Frederick... F 84
 - 6 Frostburg... M 5
 - 11 Gaithersburg... 117
 - 31 Hagerstown... 102
 - 4 Havre de Grace... C 18
 - 4 Hyattsville... 112
 - 1 Indianhead... M 10
 - 1 Kensington... 10
 - 3 Laurel... H 12
 - 3 Lawtonia... R 20
 - 1 Linthicum... G 14
 - 2 Loudoun... M 5
 - 1 Luke... N 4
 - 4 Mt. Rainier... 111
 - 4 Mt. Savage... L 5
 - 1 North East... C 19
 - 2 Oakland... O 1
 - 1 Ocean City... 22
 - 2 Orangeville... F 14
 - 3 Pocomoke... Q 22
 - 1 Port Deposit... C 18
 - 2 Riverdale... 112
 - 1 Rockville... H 10
 - 1 St. Michaels... K 17
 - 11 Salisbury... N 22
 - 1 Savage... 12
 - 2 Snow Hill... P 23
 - 6 Takoma Park... 11
 - 1 Texas... D 14
 - 1 Thurmont... C 7
 - 3 Western Port... 5
 - 4 Westminster... C 12
 - 2 Williamsport... C 5
- Pop.—Hundreds**
- 9 Boonsboro... D 6
 - 9 Midland... M 5
 - 9 Oxford... K 17
 - 9 Taneytown... B 10
 - 9 Union Bridge... C 10

DELAWARE

Area 2,370 sq. m.
Pop. 238,380

PRINCIPAL CITIES

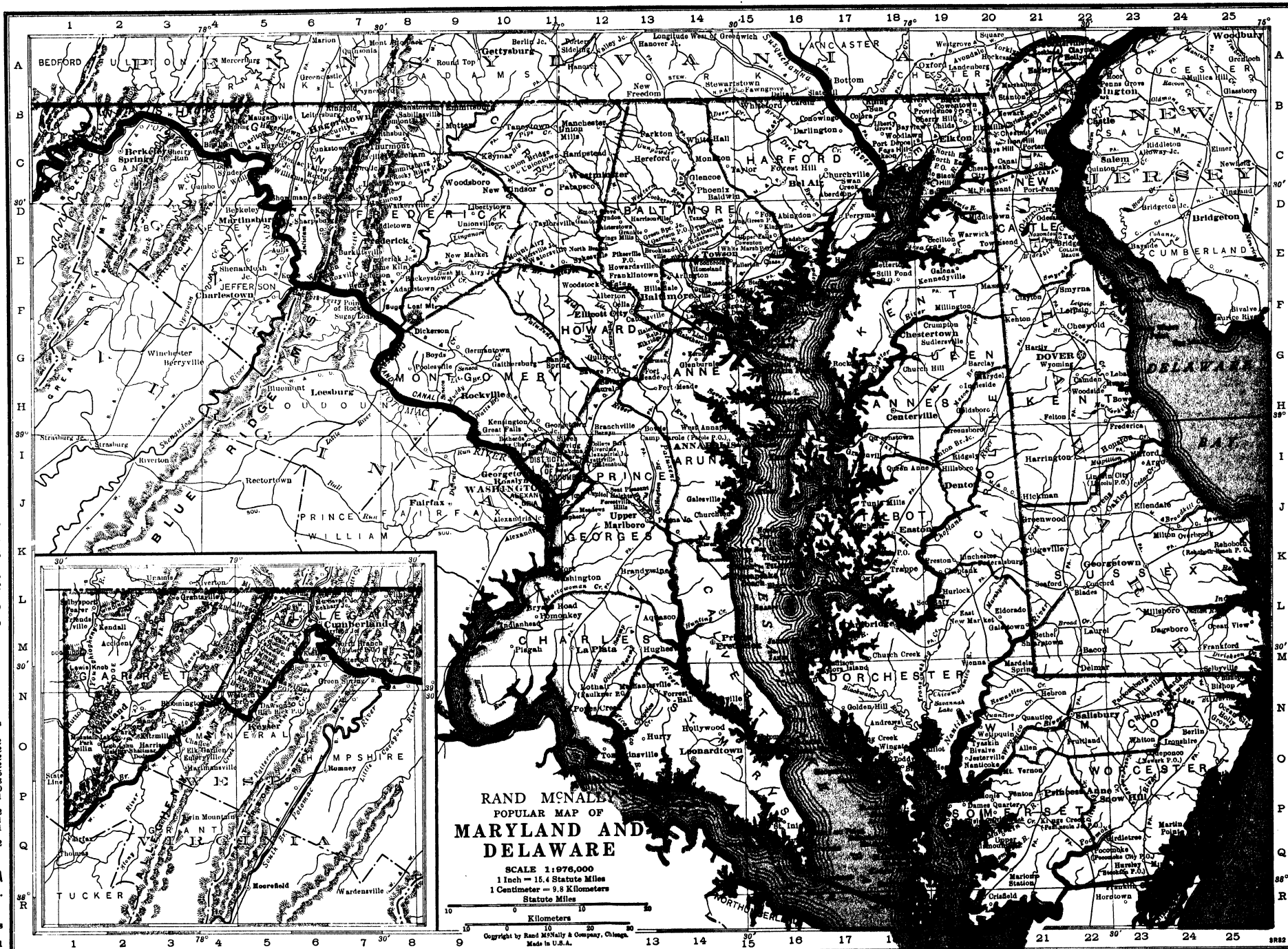
- Pop.—Thousands**
- 2 Dolmar, Md. and Del. M 22
 - 5 Dover... O 22
 - 2 Harrington... 22
 - 2 Laurel... L 22
 - 2 Lewes... 25
 - 4 Milford... 23
 - 4 Newark... 20
 - 4 New Castle... 21
 - 2 Richardson... 22
 - 2 Seaford... L 21
 - 2 Smyrna... F 21
 - 107 Wilmington... B 22

DIST. OF COLUMBIA

Area... 70 sq. m.
Pop. 486,609

CITY

- Pop.—Thousands**
- 487 Washington... J 11



RAND MCNALLY
POPULAR MAP OF
MARYLAND AND
DELAWARE

SCALE 1:976,000
1 inch = 15.4 Statute Miles
1 Centimeter = 0.8 Kilometers

Statute Miles
Kilometers

Copyright by Rand McNally & Company, Chicago.
Made in U.S.A.

foreign stock, including foreign born, foreign and mixed parentage, 10,285 or 20.3% were Italian and 8,939 or 17.6% Polish. The urban population was 123,146 or 51.7% of the total, an increase of 2,379 or 2% over 1920; the rural population was 115,234 or 48.3% of the total, an increase of 12,998 or 12.7% since 1920. In 1930 the five largest cities were Wilmington, 106,597; Dover, 4,800; Newcastle, 4,131; Newark, 3,899; Milford, 3,719.

Occupations. In 1930 98,104 persons, or 41.2% of the population, were gainful workers 10 years old or older; 78.7% of these were males and 21.3% were females; 74% were native white; 9.8% foreign-born white, and 16.2% Negro. Among the chief occupations, with number of workers, were manufacturing, 33,604; agriculture, 17,316; trade, 10,725; domestic and personal service, 10,294; transportation and communication, 9,017, and clerical occupations, 8,324.

HISTORY

HENRY HUDSON in 1609 and Cornelius Hendrickson in 1615-1616 explored the Delaware River and Delaware Bay on behalf of the Dutch; the waters took their name from the English Lord de la Warr, who anchored in the bay in 1610 or 1611. Peter Heyes, a trader in the service of the Dutch West India Company, made the first settlement in Delaware, "Hoornkill," near the present Lewes, in April 1631. The whole settlement of about thirty persons shortly was slaughtered by Indians. Peter Minuit on behalf of the South Company of Sweden headed a mixed expedition of Swedes and Dutch which built a fort on Christiana Creek in 1638; he bought from the Minquas Indians the title to the territory extending indefinitely westward from the Delaware river between Bombay Hook and the mouth of the Schuylkill. For several years after 1640 Swedish and Dutch colonists arrived, established villages, and busied themselves with fur trading, agriculture, and fisheries. Johan Printz was first governor of New Sweden (1643-1653); Johan Claudius Rising was his only successor. Differences over sovereignty led in 1655 to Gov. Stuyvesant's expedition from New Netherland with 700 men against the Swedish forts and New Sweden passed into the hands of the Dutch. There were then less than 400 residents in the colony.

When New Netherland became an English possession in 1664, both the Duke of York and Lord Baltimore, proprietor of Maryland, claimed the Delaware country. Indeed, the boundary between Maryland and Delaware was not definitely set until 1767. In 1680 the Duke of York conveyed the territory to William Penn. Until 1704 the Delaware counties were represented in the Pennsylvania legislature, although after 1690 Penn acknowledged the differences in race, religion, and economic interests—New Castle, founded as Fort Casimir by Stuyvesant in 1651, was the commercial and political capital of Delaware—by appointing a special deputy governor for the region. In 1704 Delaware established a separate legislature, but continued to recognize the authority of the govern-

nor of Pennsylvania until the Revolution. In the war with England the Delaware regiment, popularly called "the Blue Hen's Chickens," rendered exceptional service. A convention at New Castle, Sept. 21, 1776, adopted a state constitution. John McKinley was elected first governor, and Dover was named the capital. Delaware was the first state, Dec. 7, 1787, to ratify the federal Constitution. At first Federalist and then Whig in party allegiance, from 1850-95 the state customarily voted Democratic. Despite the strength of the slavery element in the two southern counties of Delaware, in 1861 the preponderance of population and wealth in New Castle kept the state from seceding, and President Lincoln's call for volunteer troops was promptly answered. The state's congressmen in Washington refused to support the Republican RECONSTRUCTION program. The enfranchisement of the Negro was resisted as long as was politically possible. An inequitable system of representation by counties, established in 1831, was not revised until, in the new constitution of 1897, a system of electoral districts was established; but this proved an inadequate corrective of the inequalities. Except for one presidential election since 1896, Delaware has been a Republican state, and in 1932 gave its three electoral votes to Hoover. C. Douglass Buck, Republican, was reelected governor.

BIBLIOGRAPHY.—J. T. Scharf, *History of Delaware, 1609-1888*, 2 vols., 1888; H. C. Conrad, *History of Delaware*, 1908.

DELAWARE, a city of central Ohio, about 24 mi. north of Columbus on the Olentangy River, and the county seat of Delaware Co. It is served by the Big Four, Chesapeake and Ohio and the Pennsylvania railroads. Delaware is the birthplace of Rutherford B. Hayes. Ohio Wesleyan University, founded in 1841, is here, and there are medicinal mineral springs. The city is in a rich agricultural and stock-raising region, has foundries and clay works, and various local manufactures, including gas stoves, flour, lumber, woollens, and chairs. Pop. 1920, 8,756; 1930, 8,675.

DELAWARE, UNIVERSITY OF, at Newark, Del., was chartered as Delaware College, a private institution, in 1833. In 1913 it became the property of the state. The Women's College, an institution for women, affiliated with Delaware College, was established in 1913. In 1921 Delaware College and Women's College were united under the name of University of Delaware. The library contains 38,000 volumes. In 1930 there were 711 students, and a faculty of 70 headed by Pres. Walter Hulihan.

DELAWARE RIVER, one of the main North American waterways to the sea in the upper Atlantic slope. It is formed in Delaware Co., New York, by two branches rising in the Catskills and flows southward, forming a dividing line between New York and Pennsylvania. At Port Jervis, N.Y., its course changes abruptly to southwest as far as the Delaware Water Gap where it has cut a gorge-like passage through the mountains. The gap is 2 mi. long and flanked by steep bluffs rising 1,000 to 2,000 ft. above

the water. From this point the river takes an irregular course southward, forming the boundary between Pennsylvania and New Jersey, and empties into Delaware Bay. The cities of Easton, Trenton, Camden, Philadelphia and Wilmington are situated on its course.

At Trenton, where the Delaware crosses the fall line and meets the tide 130 mi. from the sea, there is a fall of 8 ft. which furnishes valuable water power. At Philadelphia the river is $\frac{3}{4}$ mi. wide and just below this point it expands into Delaware Bay which varies from 2 to 3 mi. in width. The main stream is about 315 mi. long and drains an area of 12,000 sq. mi. Its chief tributaries are the Lehigh and Schuylkill. Open channel work, resulting in a 20-ft. channel from Philadelphia to Trenton, has greatly increased foreign and coastwise traffic. In 1929 this amounted to 21,674,752 tons worth \$1,160,597,336, and included raw materials, manufactured goods, coal, iron and steel and building materials.

DELAWARE WATER GAP, a narrow and picturesque gorge cut through the Kittatinny range by the Delaware River. The gap is on the border-line between Pennsylvania and New Jersey east of Stroudsburg, Pa. and 65 mi. northwest of New York City. It extends for approximately 3 mi., the walls in some parts reaching 1,400 ft. in height. The town of the same name, situated at the north end, is a popular summer resort. An interstate highway runs through the gap. Pop. 1920, 373; 1930, 443.

DELBRUECK, HANS (1848-1929), German historian and publicist. He was educated in Heidelberg, Greiswald and Bonn, and later was appointed professor of modern history at the University of Berlin. He was also, for a time, a liberal member of the Prussian Landtag and of the Parliament of the Empire. His numerous historical works show that he was a scholar of great independence of judgment. After writing a biography of Gneisenau, Delbrueck turned his attention to the history of the art of war, producing several notable works dealing with strategy in different epochs of history; of these the most important study was his *Geschichte der Kriegskunst im Rahmen der Politischen Geschichte*. During the World War, Delbrueck published two volumes on war and politics; and later was the German expert at the peace negotiations on the question of responsibility. Since 1919 he had written extensively on the question of Germany's responsibility for the World War. He died at Berlin July 14, 1929.

DELCASSÉ, THÉOPHILE (1852-1923), French statesman and diplomat, was born at Pamiers (Ariège), Mar. 1, 1852. He was educated at the college of Pamiers and at the University of Toulouse, and graduated from the last named in 1874 with the degree of *licence ès lettres*.

In 1888, he was elected to the *conseil général* of Ariège and the year following to the chamber of deputies as representative for Foix (Ariège). In the chamber of deputies, Delcassé applied himself wholeheartedly to colonial and foreign affairs, and was

under-secretary of state for the colonies from Jan. 17, 1893 until Dec. 3, 1893 and minister of colonies from May 30, 1894 until Jan. 14, 1895.

His real career began in June 1898, when he became minister of foreign affairs. He began by reversing the policy of his predecessor, Hanotaux, who had leaned toward Germany. Then, as mediator between the United States and Spain in 1898, Delcassé made two valuable friends for France, and pursued this initial advantage by negotiating with Spain over Morocco and by encouraging the intellectual *approchement* between France and the United States. He liquidated the Fashoda crisis with England (1898) so skilfully that he paved the way for complete Anglo-French accord. During a visit to St. Petersburg, 1899, he increased the scope of the Franco-Russian alliance. Moreover, by a series of negotiations, he came to an agreement with Italy which enabled him to state publicly, July 3, 1902, that in no case could Italy be a party to an aggressive war against France. His conciliatory efforts in regard to England culminated in the agreement of Apr. 8, 1904, which settled all outstanding disputes and became the foundation stone of the Anglo-French Entente. Buoyed up by the success of his policies, Delcassé proceeded to extend French influence in Morocco at a rapid rate, to the consternation of the Germans who were not consulted. This precipitated the Moroccan crisis of 1905 and likewise the fall of Delcassé from the post of foreign affairs, June 6, 1905. In Mar. 1911, he became minister of marine and reorganized and revived that department before leaving office in Jan. 1913.

Nominated ambassador to Russia to consolidate the Franco-Russian Alliance early in 1913, Delcassé returned to Paris in the spring of 1914 and agitated for the three years' military service law. In Aug. 1914, he became minister of foreign affairs once more, and did good service in helping to bring Italy into the war on the allied side, and in negotiating the Pact of London against separate peace. He resigned office, Oct. 13, 1915; retired from politics in 1919; and died at Nice, Feb. 22, 1923. C. W. P.

DELEDDA, GRAZIA (1875-), Italian novelist, was born at Nuoro, Sardinia, in 1875, and spent her first 25 years there. She then commenced to write those racy novels of Sardinian peasant life through which Sardinia definitely entered European literature. Typical novels that might be cited are *Cenere*, 1903, *Vecchio della Montagna*, 1919, and *La Madre*, translated in 1923 as *Mother*. Her work is famous for its imaginative and descriptive qualities and in its composite effect paints a portrait of the Sardinian race amidst the primitive violence of the island. Deledda is known as a realist in Italian fiction, but the ethical import of her novels justly designated her for the Nobel Prize, awarded to her in 1927 for "work of an idealistic tendency."

DE LESSEPS. See LESSEPS, FERDINAND, VICOMTE DE.

DELFT, a city in the Dutch province of South Holland, southeast of The Hague, transected by many

canals, which unite it with the capital. Prominent among the public buildings are the Princes' Court, where William I of Orange was shot, the large city hall, built in 1618, with a Gothic belfry, and a museum with a collection of rare paintings, the Gothic church with a leaning 11th century tower, the New Church, 1412-76, with fine chimes and the mortuary chapel of the House of Orange-Nassau. In the 17th and 18th centuries the city was renowned for its factories of faience. There are artillery shops and gun factories, also plants making blankets, wall-paper, cigars, soap, oil, glass, leather and scientific instruments. Delft has a polytechnical school and other higher educational institutes. In 1070 a castle was built here for Duke Gottfried, the Hunchback of Lorraine, and later it became the residence of William I of Orange. Pop. 1930, 50,555.

DELFTWARE, a kind of stanniferous faience or tin-enamel pottery first manufactured in Delft, Holland, in the 16th century. It is decorated by an "inglaze" painting process, color and brilliant enamel being fixed at one firing. Delftware was a definite attempt to imitate the costly porcelains brought from the Far East by the Dutch trading vessels, and the best examples are faithful copies of Chinese and Japanese porcelains. At first only the blue color, now known as "Delft blue," was used, but soon green, red, yellow, brown, purple and gold were added. England began to manufacture delftware in the early 17th century, and England and Holland are now the important centers of manufacture.

DELHI, capital of British India since 1912, situated in what was formerly the southeastern corner of the province of Punjab. But by a proclamation issued Oct. 1, 1912, the city and its surroundings constitute a separate province. It is the sixth city of India in size; approximately one third of its inhabitants are Mohammedans. Pop. 1922, 304,420; 1931, 439,736.

It owes its importance in the main to its strategic position at the head of the two great divisions of the Hindustan Plain: the wide plains of the Ganges and the Punjab. From Delhi any point in the plains is easily accessible. The province lies where the great desert and the hills of the plateau on the south somewhat closely approach the Himalayan chain. Therefore it was inevitable that the invaders of India from the northwest would avoid crossing the desert and be compelled to pass near the site of Delhi before they could reach the fertile plains of the Ganges. Boats could go on the Jumna all the way from Delhi to Calcutta. The land routes from the northwest there joined the water routes to the northeast. In modern times railways have largely replaced these, and Delhi has become a great railway center, easily accessible from all parts of India. Irrigation has increased the fertility of the surrounding lands; a large quantity of cotton is grown and sent to Delhi, where there are now modern cotton mills. The other manufactures are sugar, flour, metal-work and jewelry.

The new capital with its magnificent buildings stands a short distance from the old city, which was

the capital of the Mogul empire until 1605. The former greatness of the old city is still attested by several beautiful buildings, conspicuous among which are the Jama-Masjid, the largest and finest mosque in India, and the palace of the Emperor Shah Jehan. Delhi never really recovered from the blow inflicted on it in 1739 by Nadir Shah, who carried off vast treasures in gold and precious stones, estimated to be worth from \$400,000,000 to \$500,000,000. At a convenient distance to the north, on the healthy heights of the Himalayas, is SIMLA, the hot-weather seat of the government.

DELHI, SIEGE OF, an action occurring in 1857 during the Sepoy Mutiny. Delhi was the headquarters of the king, representative of the Great Mogul, and of the revolutionary movement, and in May 1857 it harbored many of the mutineers. After defeating the Bengal mutineers in the field, two British columns converged on Delhi in June, joined by a third bringing siege guns and commanded by Brigadier-General John Nicholson. On Sept. 14 the three columns advanced on the walls, two entering Delhi by breaches effected by artillery, and a third by dynamiting the Kashmir Gate. The city was captured Sept. 20. Nicholson died three days afterward of wounds received in the assault inside Delhi.

DELIAN LEAGUE, a confederation of Greek cities formed after the expulsion of the Persians from Greece, 478 B.C. The islands of the Aegean Sea, and the Greek cities of the Ionic and Pontic coasts still subject to Persia, accepted Athens, the chief naval power of Greece and a growing commercial center, as their leader in a combined aggressive effort against Persia. Ten Athenian commissioners were to collect ships or money from the confederates. The treasury was at Delos, and the Council, where all were equally represented, met there. The Athenian Cimon struck the first blow against Persia in 476 B.C.; but the destruction of the Persian fleet at the Eurymedon, 468 B.C., was his greatest victory. When the Persian danger was no longer menacing, the league tended to dissolve, for political union was alien to the Greek spirit. Athens was faced with the loss of her allies, valuable to her commercially and in view of an impending conflict with Sparta. She resisted their efforts to secede, compelling discontented members, like Naxos and Thasos, to adhere; and she forced in such near-by states as Carystus. In 454 B.C. the treasury was removed to Athens. The contributions, fixed by Aristides, were increased and used not only for anti-Persian activities, but for the adornment of the city; litigations involving allies were tried at Athens. The league was rapidly becoming an empire. The PELOPONNESIAN WAR was a severe trial; strong members like Lesbos joined Sparta, weak ones attempted neutrality and were coerced or, like Melos, destroyed. Athenian defeat in 404 B.C. dissolved the league, but it was reconstituted on a small scale in 393 B.C., with Persian connivance, as a weight against Sparta.

DELIBES, CLÉMENT PHILIBERT LÉO (1836-91), French music composer, was born in St. Ger-

main-du-Val, Feb. 21, 1836. He produced several operas, of which *LAKME* was the most successful. His deft melodic manner found its happiest expression in the ballet, notably in *Coppelia*, *Sylvia*, and *La Source*. In 1881 he joined the faculty of the Paris Conservatoire, and in 1884 became a member of the French Academy. He died at Paris, Jan. 16, 1891.

DELILAH, the Biblical heroine of the Philistines and the beloved of Samson. Bribed by the Philistines, Delilah after repeated failures cajoled him into revealing the secret of his great strength. His locks were shorn during sleep and Samson, deprived of his remarkable powers, was delivered into the hands of the Philistines. The well-known story is found in Judges 16.

DELIQUESCENCE, the action of some crystalline HYDRATES in absorbing moisture from the air and dissolving in it to finally form a solution. Deliquescence is due to the existence in the hydrate of a vapor pressure below that in the atmosphere. The hydrate of calcium chloride ($\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$) is a deliquescent substance, used commercially to dry gases.

DELLA ROBBIA, LUCA (1399?-1482), most famous of a family of Florentine sculptors, was born at Florence, in 1399 or 1400. Little is known of his early youth, but it is probable that he studied with LORENZO Ghiberti and that he learned from DONATELLO his style of treating bas-reliefs and the management of planes. Luca's most important work, the famous marble singing choir, for the cathedral of Santa Maria del Fiore, now in the Cathedral Museum, was executed between 1431-40. The 10 high relief panels of dancing and singing children demonstrate that although Luca's knowledge of the antique was scantier than either Ghiberti's or Donatello's, he was the more truly Greek in spirit. Other works executed by Luca were five lozenge-shaped reliefs, from designs by Giotto, for the Campanile of the Cathedral, 1437; terra cotta lunettes of the *Resurrection* and *Ascension*, 1443, and a pair of bronze doors for the Sagrestia Nuova, 1446-70. The marble tomb of Bishop Federighi, in the church of S. Trinita, 1455-57, is one of the greatest monuments of the Renaissance.

Of Luca's authentic works in glazed terra cotta, the finest are the *Madonna with Angels* in the Via dell' Agnolo, Florence; the series of medallion portraits of the apostles and evangelists in the Pazzi Chapel; the exquisite ceiling medallions in the Portuguese Chapel of S. Miniato and several works in the Bargello. Luca died at Florence, Feb. 20, 1482.

DELMEDIGO, eminent Jewish family which originated in Germany, whence it subsequently emigrated to Crete. The founder of the family was Judah Delmedigo, who went to Crete at the end of the 14th century. In Crete the later members of the Delmedigo family distinguished themselves as mathematicians and philosophers.

The most important of these was Elijah Delmedigo, called also Elias Cretensis (Elijah of Crete), who was born at Candia, Crete, in 1463 (or 1460) and died at Candia in 1498 (or 1497). He lived in Italy for

many years, and lectured publicly on philosophy before large audiences in Padua and Florence. In the first-named city he was at the same time the head of the Talmudical school there. Elijah Delmedigo was a firm opponent of, Cabala as well as a keen critic of Talmudic Judaism, and was regarded as a great authority on the philosophy of Aristotle and Averroes. Pico della Mirandola was his personal friend; indeed, at his request Elijah translated many of the writings of Averroes into Latin, and wrote several original Latin and Hebrew treatises in explanation of his philosophy. Elijah's best known work was *Behinath Hadath*, or *The Investigation of Religion*, a work in which he borrowed frequently from Averroes's ideas and in which he advocated the theory that it is the privilege of the philosopher so to interpret the doctrines of religion that they avoid all conflict with philosophy; the ordinary person, however, has to adhere to the literal meaning of the religious teachings. He declared that religion does not consist of logical syllogisms, but has as its prime purpose the inculcation of moral doctrines and the practice of a moral life.

Elijah's son was Judah ben Elijah Delmedigo, who was born at Candia, Crete, and became famous as a Talmud teacher. He was the greatgrandfather of Joseph Solomon Delmedigo.

Elijah ben Eliezer Delmedigo was the third outstanding member of the family; he was a Cretan rabbi and Talmudist in the second half of the 16th and the first half of the 17th century, and was the father of Joseph Solomon Delmedigo. He was the author of many Halachic, or legal, decisions.

Joseph Solomon Delmedigo was the fourth prominent member of the Delmedigo family, distinguished as a philosopher and mathematician. He was born at Candia, Crete, in 1591, and died at Prague in 1655. He studied astronomy under Galileo and medicine at the University of Padua, after which he traveled through Egypt, Turkey and Poland, settled for a time as rabbi of a Jewish congregation at Amsterdam, and finally made his home in Prague. In his various works, most of which have been lost, he discussed metaphysical and mathematical problems and questions of natural science.

A. SH.

See Graetz, *History of the Jews*, 1926.

DELONEY, THOMAS (1543-1600), English writer, was born probably at London about 1543. A silk-weaver by trade, he was inspired by the coming of the Armada to write in 1588 three patriotic diatribes. There followed a collection of ballads by Deloney, including some by other poets, entitled *The Garland of Good Will*. In it was printed *The Blind Beggar of Bednall Green*, usually attributed to Deloney. *A Collection of Strange Histories* appeared in later editions as *The Royal Garland of Love and Delight* and *The Garland of Delight*. MICHAEL DRAYTON characterizes Deloney's work as "full of state and pleasing." Deloney died about 1600.

DE LORRIS. See GUILLAUME DE LORRIS.

DELOS, the smallest of the Cyclades Islands, in the Aegean Sea, famous as the seat of the worship

of Apollo. A great temple to the god stood here in the 3rd century B.C.

DELPHI, the ancient name of the modern Kastrí in Greece, a town on the southwest spur of Parnassus in the valley of Phocis. Delphi was named for Delpheus, son of Apollo, and was the seat of the famous oracle of Apollo. The legend was that as a baby Apollo slew the serpent Python who guarded the oracle. This story was dramatically told each year at the festival of Septeria. The city was also called Pytho; the Pythian games were celebrated here by the AMPHICTYONIC LEAGUE which made Delphi its headquarters. Here too were the treasuries of Athens, Cnidus, Sicyon and Thebes. During the Sacred War many of the votive offerings were melted down by the Phocians who had to pay 10,000 talents for the sacrilege. Sulla, Nero and Constantine stole many of the treasures from Delphi.

DELPHINIUM, a genus of hardy herbs of the crowfoot family grown in gardens for their beautiful blue, red, pink or white single and double flowers. They are largely used by florists because of their long lasting character. The name is derived from the Greek word for dolphin which is suggestive of the form of the flower. Although the names delphinium and larkspur apply to all members of the genus, popular usage is restricting the former to the perennial species and their varieties and the latter to the annuals. See also LARKSPUR.

DELPHINUS (gen. *Delphini*), the dolphin, a small but striking constellation directly east of Aquila. It is composed of four stars of the fourth magnitude forming a parallelogram, with a fifth, equally bright star just south. See STAR: *map*.

DELPHOS, a city in Allen and Van Wert counties, western Ohio, situated on the Miami and Erie canals, 16 mi. northwest of Lima. Bus lines and three railroads afford transportation. Grain and sugar beets are the chief crops of this region. The city has machine shops and several factories. Delphos was founded in 1844; incorporated in 1850. Pop. 1920, 5,745; 1930, 5,672.

DEL RIO, a city in Val Verde Co., southwestern Texas. It is situated on the Rio Grande, opposite Villa Acuna, Mexico, and is 170 mi. west of San Antonio. The city is served by the Southern Pacific Railroad. Del Rio is a port of entry, trade center and shipping market for an extensive agricultural region producing principally wool, mohair and garden crops. In 1929 the retail trade amounted to \$7,045,108. The first permanent settlers came about 1872. Pop. 1920, 10,589; 1930, 11,693.

DELSARTE, FRANÇOIS ALEXANDRE (1811-71), French teacher of expression, was born in Solesmes, France, in 1811. He entered the Paris Conservatoire in 1831, and after coaching with Gardané and Ponchard he made his début in a tenor rôle at the Opéra-Comique, Paris. He left the opera stage to devote his time to a method of expression which became widely known in the United States as Delsartian Physical Culture. He died at Paris in 1871.

DELTA, the roughly fan-shaped deposit built up by sediment at the mouth of a river. As the stream enters another body of water, its current is checked. It promptly drops its load, often impeding its own waters, which must divide and subdivide to circumvent the obstructions.

Deltas develop most perfectly at the mouths of streams discharging into lakes or sheltered bays. Great rivers, however, are able to push their deltas seaward against sea waves, as is seen in the Mississippi, which is building out delta-land into the Gulf of Mexico at the rate of about 340 ft. a year. The delta of the combined Ganges and Brahmaputra has grown, despite strong tidal currents, to an area of 40,000 to 50,000 square miles, almost equal to that of the state of Illinois. Delta-made land forms the site of the great tourist center of Interlaken, Switzerland, and of towns on Lake Como.

Because of their extreme fertility, alluvial delta-plains, like those of the Nile, in Egypt, the Hwang-ho, in China, the Rhine, in Belgium and Holland, and the Po in Italy, are among the most thickly populated regions of the world.

DEMAGOGY, the rule of demagogues, insincere politicians and unprincipled agitators who stir up popular passion and prejudice for their own ends.

DEMAND LOAN. See CALL LOAN.

DEMAVEND, a volcanic mountain of Persia, the highest peak of the Elburz Range, about 40 mi. northeast of Teheran. Rising to a height of 17,930 ft., it bears evidence of having erupted during the latest geological period, or probably within the historical period. The crater is 255 ft. in diameter, almost surrounded by rocks of basalt, limestone and sulphur, the basin within being filled with snow. The summit was first reached by William T. Thomson, an Englishman, in 1837.

DEMBEA, LAKE, or **LAKE TSANA**, in Abyssinia, northeastern Africa, between 12° N. lat. and 37° 25' E. long. It is about 6,000 ft. above sea level and drains an area including its own surface of about 5,400 sq. mi. The lake is somewhat pear-shaped, approximately 45 mi. long, 45 mi. wide at its maximum and occupies an area of about 1,150 sq. mi. The Abai or upper Blue Nile flows from the bay at its southeastern extremity. Several islands, the largest of which is Dek, are found in the lake.

DEMENTIA PRAECOX, a form of insanity which is of uncertain cause and insidious in onset. The first signs, beginning about puberty, are queer thoughts and actions which gradually increase in peculiarity. The outstanding symptoms are apathy, inattention and slovenliness. Bizarre manners and attitudes develop and are associated with delusions, illusions, accusatory ideas and hallucinations. The judgment undergoes a gradual deterioration, resulting in dementia.

The disease is differentiated into four types, according to the outstanding symptoms. The *simple* type is characterized by a gradual development of seclusiveness, irritability, disinterestedness and gradual men-

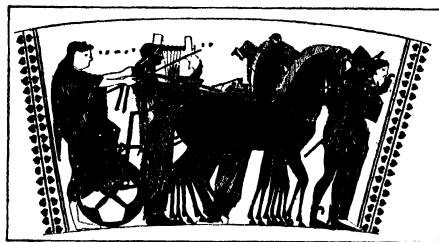
tal decay. In the *hebephrenic* type, the onset is sudden, with confusion, depression, persecutory delusions and hallucinations. These acute symptoms may decrease, but the personality defect with milder symptoms continues. The *catatonic* type is named from the muscular rigidity which characterizes it and which may progress to catalepsy. A depression ushers in the attack and is followed by stupor, excitement, or alternate phases of the two. Either negativism or suggestibility is associated with the catalepsy. The *paranoid* form is typified by systematized fantastic delusions of persecution and of grandeur with auditory hallucinations.

In general, dementia praecox is a progressive disease leading to dementia for which no reliable treatment has been found, but occasionally, cases are encountered in which there is improvement or complete recovery. See also INSANITY. R. Gr.

DEMERARA. See BRITISH GUIANA.

DEMESNE, an old English legal term denoting lands of which the lord had absolute ownership, as distinguished from feudal lands which he had from a superior. Demesne referred particularly to the lands which the lord retained under his particular control for the purpose of supplying needs to his household, as distinguished from those "farmed out" to tenants. From this it has a restricted modern meaning, denoting a manor and the land immediately attached to it.

DEMETER, in Greek mythology, goddess of the grain and agriculture, the same as the Roman CERES. She was the daughter of CRONUS and RHEA, and sister of ZEUS. Her daughter PROSERPINE was carried off by PLUTO, in punishment for which Demeter



DEMETER, GODDESS OF AGRICULTURE AND PROTECTRESS OF MARRIAGE

From a painting on an archaic hydria, or water jar

brought dearth upon the land, until Zeus promised that her daughter might visit her for at least half of the year. While seeking her daughter, Demeter had been treated so hospitably by the people of Eleusis that in return she revealed to them her sacred rites. The Eleusinians celebrated these mysteries in her honor.

DEMING, a town in southwestern New Mexico, the county seat of Luna Co. It is situated in the Mimbres Valley, 80 mi. northwest of El Paso, Tex. and served by two railroads and by bus lines. Deming is a trade center in an irrigated region producing fruit, grain, vegetables, poultry and livestock. A dry

climate with much sunshine makes Deming a popular health resort. Nearby are interesting excavations of prehistoric ruins. Deming was founded in 1881. Pop. 1920, 3,212; 1930, 3,377.

DEMOCRACY, a form of government in which the majority of the adult population participates directly or indirectly. It is founded on the theory that the average man is qualified to participate in the affairs of state and that he is particularly qualified to select rulers who will govern in the interests of the nation. It is contended in behalf of this form of government that only through popular control is it possible to prevent the government from ruling in its own interests or in the interests of some particular class. Equally important with the influence of the people upon government, however, is the influence of the government upon the people. Democracy, so it is argued, is in itself one of the most powerful educational forces in the world to-day, lifting entire peoples from the contemplation of their own personal affairs to a consideration of problems of national and international magnitude. S. C. W.

BIBLIOGRAPHY.—J. W. Garner, *Introduction to Political Science*, 1910.

DEMOCRATIC PARTY, one of the two major parties of the United States. It was founded by THOMAS JEFFERSON in 1792 as the DEMOCRATIC-REPUBLICAN PARTY. The members soon shortened the name to Republican although the opposition Federalist Party (see FEDERALISTS) frequently referred to them as Democrats, which word at that time carried a measure of opprobrium as a result of the excesses of the French Revolution. Jefferson as Washington's Secretary of State, 1789-93, disapproved of the policies of the National Government, chiefly on the ground that it utilized its power to exploit the many for the benefit of the few and also that it attempted to exercise powers as the central Government which had not been delegated to it by the Constitution. He and his followers favored states rights and a strict construction of the Constitution as opposed to excessive centralization of government and a liberal interpretation of the Constitution. The party originally attracted to its ranks all those who were opposed to Federalist policies, including most of those who had originally opposed the adoption of the Constitution, some who like Jefferson had mildly favored it, and others who like JAMES MADISON had worked vigorously for its ratification. Members of both the Senate and the House could be classed as members of the Republican Party from the time of its inception.

Jefferson resigned from Washington's Cabinet in 1793 and thereafter intensively worked to consolidate the opponents of the Federalists into a controlling party. In 1796 they elected Jefferson to the Vice-Presidency largely because of the method of selecting the President prescribed by the original Constitution which was changed after the Jefferson-Burr mix-up of 1801. In 1801 Jefferson as a Republican became President, and the party, later with a changed name, controlled the National Government until the Civil

WAR, with the exception of the Whig successes of WILLIAM HENRY HARRISON and ZACHARY TAYLOR. An exception also might be made of JOHN QUINCY ADAMS. Although Jefferson's success in 1800 is generally explained as a protest against obnoxious Federalist policies, examination of the election returns shows that it was the switching of New York State from John Adams, who carried it in 1796, to Jefferson in 1800 which elected the latter. In his inaugural address of 1801, Jefferson asserted principles which are regarded as traditional with the Democratic Party, among them being "Equal and exact justice to all men, of whatever state or persuasion, religious or political"; and "the support of the state governments in all their rights." Many of the avowed principles of the party had been expressed when the rival party was in power, and as might be expected the Republicans were reluctant to adhere strictly to their own canons when they had assumed control. The purchase of Louisiana, 1803, for instance was possible only with a liberal construction of the Constitution, and the behavior of ANDREW JACKSON during the South Carolina Nullification episode, 1832, could hardly be classed as friendliness to states rights.

Oddly enough approximately the same arguments which the Republicans used against the Federalists before 1800, that one section of the country was utilizing the National Government to exploit the remainder, were used after 1800 by the Federalists against the Republicans. The rival Federalist Party continued to control local strongholds, but never again after Jefferson's advent as President did it gain control of the National Government. Its last presidential candidate was RUFUS KING against JAMES MONROE in 1816, and following that for more than eight years but one party existed in national politics.

Nevertheless irreconcilable differences of opinion existed within the party and during the Administration of John Quincy Adams, 1825-29, two national parties once more made their appearance. Four candidates for the Presidency, John Quincy Adams, Jackson, WILLIAM HARRIS CRAWFORD and HENRY CLAY, all Republicans, contested the Presidency in 1824. No one received a majority, with the result that the Presidency was decided by Congress which selected Adams. Jackson declared that he had been the victim of a "corrupt bargain" and set to work to reverse the decision by the National vote in 1828. Adams's followers who favored a protective tariff and internal improvements at national expense and approved of the United States Bank called themselves National Republicans in order to distinguish themselves from other factions in the party. The Jacksonians, desirous of emphasizing their belief in the equality of all men, adopted the original Jeffersonian name of Democratic Republicans which was later shortened to Democrats. The Jacksonian Democrats swept their hero Andrew Jackson into the Presidency in 1828 by an electoral vote of 178 to 83 for Adams. Every state south of the Mason and Dixon line except Maryland and Delaware and every state west of the Alleghenies gave its

entire vote to Jackson, and he had all the electors of Pennsylvania, 20 out of 36 in New York, and 5 out of 11 in Maryland. Although Jackson personally administered the Presidency in an autocratic manner, the spirit of his party was the glorification of the common man. Jacksonian Democracy differed from the earlier Jeffersonian Democracy in the respect that it endorsed a liberalism in the extension of the franchise, a willingness to place in office persons of humble origin and a vigorous National policy to promote the country's welfare which were never evident among the Jeffersonians.

Prior to 1824 the customary manner of selecting the Presidential nominee had been by caucus of the party's members of both houses of Congress. In 1824 Crawford had been the choice of the lightly attended Congressional caucus, and the other candidates of that campaign had been placed in nomination by various other bodies. In 1832 the Democrats followed the example of the Anti-Masons and the Whigs and held a National Nominating Convention at Baltimore. The convention which nominated Jackson adopted a rule that a two-thirds majority of the delegates was necessary for a choice, thereby establishing a precedent which has continued to the present day and has prevented the nomination of many mere majority candidates. After 1832 the WHIG PARTY united the opposition to the Democrats and in 1840 it succeeded in electing William Henry Harrison in opposition to MARTIN VAN BUREN, then a candidate for his second term. The severe business depression which began in 1837 and continued into the Presidential election year of 1840 was an important factor in the Democratic defeat. In 1844 the Democrats returned to power with JAMES K. POLK as the successful Presidential candidate, and they were in 1848 for the second time defeated by the Whigs who ran ZACHARY TAYLOR, the Mexican War hero.

Slavery Issue. The slavery issue which cut across party lines thereafter disrupted the rival Whig Party which after 1852 rapidly declined as a power in national politics. The Democrats were successful in 1852 with FRANKLIN PIERCE and again in 1856 with JAMES BUCHANAN. Although most of the strength of the Democrats came from the South they also had support from the West and the North so that there was considerable justification to the contention of their adherents that they were the only truly National party and that the others were chiefly sectional. In 1860 the slavery issue which had earlier disintegrated the Whigs split the Democrats into two factions, North and South. The Democratic Convention met at Charleston, S.C., on Apr. 23. The convention endorsed the doctrine of popular sovereignty of STEPHEN A. DOUGLAS, which was unacceptable to the Southern pro-slavery extremists, and, headed by WILLIAM L. YANCEY and the entire Alabama delegation, a majority of the delegates from Mississippi, Louisiana, South Carolina, Florida, Texas, Arkansas and Georgia left the hall. After their departure Douglas failed to get the nomination because of the decision that a

two-thirds majority of the whole convention was necessary, which Douglas was unable to muster. In June the convention which reassembled at Baltimore nominated Douglas and Herschel V. Johnson of Georgia. The Democratic bolters met in the same city and selected as their candidate JOHN BRECKINRIDGE of Kentucky and Joseph Lane of Oregon. In addition to the Republican ticket of Lincoln and Hamlin, there was a fourth party in the field, the Constitutional Unionists with John Bell of Tennessee and EDWARD EVERETT of Massachusetts as their candidates. Analysis of the figures shows that the two wings of the Democratic Party together polled a larger popular vote than did Lincoln, who, despite the fact that he received approximately only 40% of the total popular vote, was elected by an electoral vote of 180 out of a possible total of 303. The election continued the Democratic control of Congress with a majority of 8 in the Senate and of 21 in the House, which majority disappeared with the withdrawal of members from the seceding states.

Among the Democrats who remained with the National Government during the Civil War there was no uniformity of opinion or of policy. Some supported the Republican government whereas the attitude of the others ranged from passivity to emphatic disapproval of the war. In 1864 the Democratic National Convention, with a platform which among other things demanded "that immediate efforts be made for a cessation of hostilities," nominated Gen. GEORGE B. MCCLELLAN, who promptly repudiated that part of the platform. Lincoln's electoral vote triumph of 212 to 21 does not reflect his popular majority, which was less than 400,000 in a total vote of 4,000,000. For a decade after the Civil War the Democratic Party was obscured by the Republicans for two principal reasons: first, the policy of Reconstruction enabled the Republicans politically to control the region which was normally Democratic; secondly in the North, Republican propaganda emphasized, and many persons regarded, the rival party as the party of the Rebellion. In 1868 the Democratic candidate, HORATIO SEYMOUR, wartime governor of New York, was defeated by ULYSSES GRANT, and in 1872 the fortunes of the Democrats were at such a low ebb that they endorsed the candidacy of the Liberal Republican nominee, HORACE GREELEY, who had been a consistent enemy of the Democratic Party. In connection with the candidacy of Seymour it is interesting to note that it was the beginning of the Democratic tendency to name former governors of New York as Presidential nominees: Seymour in 1868, SAMUEL TILDEN in 1876, GROVER CLEVELAND in 1884, 1888 and 1892, and ALFRED SMITH in 1928.

The Solid South. The outcome of the Republican reconstruction policy was to infuriate the South to the point that after the withdrawal of military control, the Democratic Party was always assured of carrying the former Confederate States, and the Democratic "Solid South" became a tradition which showed no signs of disappearance until the election of 1928.

In the North during the decade following the war many factors combined to form an ever-increasing body of Republican opposition. Many persons believed that Republican reconstruction policies were unnecessarily severe, unwise and even unjust, besides creating indescribable corruption in state and smaller sub-divisions of local Governments. In addition, there was widespread disapproval of the continuance of the high war-time tariff, of the Governmental policy of currency deflation, and of the many political and Governmental scandals which were revealed during Grant's second administration. In 1874 the Democrats gained a controlling majority of the House of Representatives.

The Democratic Party, confronted with an excellent chance of success in 1876, nominated for the Presidency Samuel J. Tilden, a governor of New York with a reputation as a reformer. Tilden's victory was generally conceded upon the close of election day; but afterwards it appeared that the electoral votes of South Carolina, Florida, Georgia and one vote from Oregon were disputed by the two parties, and Tilden needed one of these electoral votes for a majority. The two parties upon the convening of Congress in Dec. 1876 agreed that an electoral commission of 15 men should decide the issue, the membership of the commission to consist of five senators, five representatives and five justices of the Supreme Court. The Republican-controlled Senate appointed three Republicans and two Democrats, the Democrat-controlled House selected three Democrats and two Republicans, and by agreement the five justices were to be two Republicans, two Democrats and David Davis of Illinois, an Independent. When made, the agreement seemed to favor the Democrats. It was expected that the Democrats and Republicans would vote along party lines; but Judge Davis would probably decide at least one of the disputes in favor of the Democrats, and one vote was all that Tilden needed. Before the commission met, Judge Davis was elected to the United States Senate by the Illinois legislature, and he withdrew from the commission stating that his support had come chiefly from the Democrats and he therefore could no longer be regarded as non-partisan. There were no other independent members of the Supreme Court, so that the fifth justice had to be a Republican. The commission, which therefore contained eight Republicans and seven Democrats, proceeded to award all of the disputed votes to Hayes by the strictly partisan vote of eight to seven. Tilden magnanimously urged the country to abide by the decision, and thus exhorted, most of the Democrats complied.

In 1880, the Democrats named as their nominee, WINFIELD S. HANCOCK, one of the Union Generals of the Civil War. Hancock lacked the political experience of his opponent, JAMES A. GARFIELD, and the Republicans ridiculed his assertion that the tariff was a local issue despite its correctness in many respects. Hancock carried the "Solid South" for the first time since the Civil War, and although Garfield

won by an electoral vote of 214 to 155 his popular majority was less than 9,000 votes. In 1884, in one of the most scurrilous campaigns in American history, one in which issues were obscured by personal abuse, Grover Cleveland triumphed as the first successful Democratic Presidential candidate since the Civil War. As in all Presidential contests innumerable complex factors produced the victory; but Blaine's defeat was popularly attributed to the loss of New York State, which in turn was explained by Blaine's seeming acquiescence with a welcoming speech in New York City of a Rev. S. D. Burchard who characterized the Democrats as "the party whose antecedents are rum, Romanism and rebellion." Against the advice of friends, Cleveland, with his customary disregard of consequences and independence of action, in his Presidential message of 1887 urged a drastic downward revision of the tariff. The Republicans immediately converted his request into the issue of the campaign of 1888, in which although Cleveland received a 100,000 more popular votes than did BENJAMIN HARRISON, he was defeated by an electoral vote of 233 to 168. Aided by the unpopularity of the MCKINLEY TARIFF ACT, which was passed shortly before election, the Democrats in 1890 by a landslide returned 235 members to the House to 88 for the Republicans.

Cleveland and Harrison were again the nominees respectively of the Democrats and Republicans in 1892. The platforms of the two parties in slightly different language discussed the national issues, including that of the currency in vague platitudes with the exception of the tariff problem. The Republicans declared for "the American doctrine of protection," whereas the Democrats described a protective tariff as "a robbery of the great majority of the American people for the benefit of the few" and further said that it was "a fundamental principle of the Democratic Party that the Federal Government has no constitutional power to impose and collect tariff duties except for the purpose of revenue only." The Democrat Cleveland won with a popular vote of 5,556,543 to 5,175,582 for Harrison. The electoral vote was 277 for Cleveland, 145 for Harrison, and 22 for JAMES WEAVER, the Populist candidate. The Democrats, with majorities in the House and the Senate also, for the first time since Buchanan's Administration simultaneously controlled the executive and both houses of Congress. The Democratic Wilson-Gorman Tariff Bill, 1894, only slightly reduced the provisions of the previous McKinley Tariff to the indignation of many, including Cleveland who allowed it to become a law without his signature, largely because a veto would have continued in effect the still more obnoxious McKinley Tariff schedules. The Panic of 1893, financial difficulties of the Treasury, labor disturbances, and general unrest united to defeat the Democrats in the mid-term election of 1894 in which the Republicans regained control of the Senate and of the House by the substantial majority of 248 to 104.

The National currency policy which had been a subject of sharp controversy since the Civil War, as

well as previously, was thrust forward by the diminution of the Treasury gold reserve during Cleveland's second Administration as something which had to be settled. Silver mining regions in the West, indebted farming districts and others favored bi-metallism. The currency before 1896 had been cautiously avoided as an issue by both the Democrats and Republicans. The controversy as to the merits of currency inflation or deflation was confined to geographical and industrial groupings and formed no party alignments. Responsibility for the BLAND-ALLISON ACT of 1878 and the SHERMAN SILVER PURCHASE ACT of 1890 could not be placed wholly with either party. The repeal of the latter act was by a Democratic President, Senate and House. Cleveland, as an advocate of a sound currency, however, did not represent the opinion of a large section of his party which with its strength in agrarian regions was rapidly veering towards a championship of "cheap money."

Free Silver Plank. In 1896 WILLIAM JENNINGS BRYAN with his fascinating oratory captivated the Democratic National Convention, ending with his stirring peroration, "You shall not press down upon the brow of labor this crown of thorns—you shall not crucify mankind upon a cross of gold!" An enthusiastic convention inserted in the Democratic plank a demand for free and unlimited coinage of silver at a ratio of 16 to 1 and nominated Bryan for President. The Vice-Presidential nominee was Arthur Sewall of Maine, a wealthy ship-owner and bank president, who favored free silver. Some gold Democrats bolted the convention and put up their own ticket which proved to be unimportant. The Populist Party also selected Bryan as their nominee. The outstanding issue of the vigorous campaign which followed was the currency problem with the Republican plan advocating a gold standard. WILLIAM MCKINLEY, the Republican candidate, unavailingly again sought to make the tariff the issue as it had been in 1892. McKinley won by an electoral vote of 271 to 176 with a popular vote of 7,111,607 to 6,509,052. Bryan was again the nominee of his party in 1900. Upon his insistence the free-silver plank of 1896 was repeated in the platform, but it was a dead issue and Bryan devoted his oratorical talents to assaults upon the vicious practices of unregulated big-business interests, the unprecedentedly high Dingley Tariff (*see* DINGLEY TARIFF ACT), 1897, and "the burning issue of imperialism growing out of the Spanish War."

The result of the National campaigns of 1892, 1896 and 1900 had been to fix in the popular mind a belief in the Democrats as the party of a low tariff, of an inflated currency, and of a restrained foreign policy. The convention of 1904 witnessed a struggle between the radical and conservative forces within the party. The two defeats of Bryan undoubtedly had discredited to a certain extent the Radicals. The platform was silent on the currency issue, and the nomination was awarded to a conservative, Judge ALTON B. PARKER of the New York Court of Appeals. Bryan's opposition to Parker seemed justified by the

results of the election. Parker, despite his conservatism, naturally had no appeal for Republicans, and THEODORE ROOSEVELT, the Republican nominee, had a reputation as a reformer and as an enemy of unregulated big-business which attracted many Liberals and Radicals. Judge Parker's slight gains among the Conservatives were far outweighed by losses among the Radicals. Roosevelt received 336 electoral votes to 140 for Parker, with a record popular majority of 2,540,067. Parker carried only the states of the Solid South, and for the first time since 1868 Missouri gave its electoral vote to a Republican Presidential candidate. In 1908 the Democratic Party once more turned heartily to Bryan as their nominee. The platform especially advocated reforms of big-business and denounced the Republicans as "the party of privilege and private monopoly," despite the fact that many of their suggested reforms had also been urged by Roosevelt. Bryan, in his defeat by WILLIAM TAFT, the Republican candidate, seemingly vindicated his doctrines as the proper ones for the Democratic Party since he polled approximately 1,300,000 more popular votes than had Parker, whereas Taft's vote exceeded Roosevelt's by only 49,000.

Bryan's domination continued in the National Convention of 1912. CHAMP CLARK seemed almost assured of the nomination. On one ballot he obtained 556 votes, a majority but not the necessary two-thirds. When the New York delegation transferred its vote to Clark, Bryan turned the support of the primary-instructed Nebraska delegation from Clark to WOODROW WILSON, who ultimately received the nomination on the 49th ballot. The split in the Republican Party assured the victory of Wilson, who although he failed of a majority of the popular vote received the largest electoral plurality in American history, with the exception of HERBERT HOOVER in 1928. Behind the leadership of Wilson, the Democrats among other measures reduced the tariff substantially, created the FEDERAL RESERVE SYSTEM, passed the Clayton Act which curbed many alleged evil practices of big-business interests, and established the Federal Farm Loan Board. Wilson was again elected in 1916 in a campaign which emphasized that he had kept the nation out of a war with Germany. During the war partisan politics were mostly absent from Congress; yet Wilson during Oct. 1918 issued a request to the nation to return a Democratic House as an endorsement of his Administration and also as an assurance of no Republican opposition to needful measures. The effect of this appeal to the country is hard to calculate. The Republicans, however, showed fairly conclusively that generally they had supported Administration measures more consistently than had the Democrats. In the election, the Republicans won majorities in both houses. President Wilson insisted that the Versailles Treaty be ratified by the Senate without any alteration of the provision for membership in the League of Nations by the United States. The rejection of the treaty by the Senate and President Wilson's insistence caused membership in the League

of Nations to be the issue of the campaign of 1920 in which the Democratic nominee JAMES M. COX of Ohio opposed WARREN G. HARDING. Harding polled almost twice as many popular votes as did his Democratic opponent, the result being 16,152,200 to 9,147,353. It is impossible to determine the precise cause of election defeats in American national elections with the numerous cross-currents which operate to produce the result, and the only cautious explanation of the successive staggering defeats of the Democratic Party in 1920, 1924 and 1928 is on three scores: 1. general disapproval of the Democratic Administrations under Wilson; 2, association in the popular mind of the Republican Party with prosperity; and 3, dissension within the Democratic ranks. In amplification of the third point, WILLIAM G. McADOO and Alfred E. Smith in the Democratic National Convention of 1924 deadlocked each other, each incapable of obtaining the necessary two-thirds vote until JOHN W. DAVIS was selected as a compromise candidate on the 103rd ballot. The latter's defeat was as severe as Cox's in 1920.

In 1928 Alfred E. Smith was nominated, and his open disapproval of the 18th Amendment coupled with his Catholic religion may have led to the startling transfer from the hitherto Democratic Solid South to the Republican column of Virginia, North Carolina, Florida and Texas, in addition to the so-called border states, Tennessee, Kentucky, Missouri and Oklahoma. Elsewhere the victory probably should be attributed to the prosperity of the country and a continuation of the forces which had crushed the Democrats in 1920 and 1924. After the election of 1928, the Democratic Party appeared to be prostrate, and many assumed that it might disintegrate as had the earlier Federalist and Whig parties. The profound depression which became acutely evident in the United States and elsewhere in the world in 1929 reacted unfavorably against the Republicans as the party in power. When Congress met in Dec. 1931, the Democrats were able to elect JOHN GARNER of Texas as the Speaker of the House. In July 1932, the Democratic Party nominated Franklin D. Roosevelt for President and Garner for Vice-President. It adopted a plank for straight repeal of the 18th Amendment. In the November election, the party carried all but six states.

In recent years, the doctrines calling for specific action which formerly distinguished the Democrats from the other major party have been modified and the mingling of contradictory aims and programs within both parties has produced between the two parties a dispute more of men than of measures. S. McK.

BIBLIOGRAPHY.—E. Stanwood, *A History of the Presidency*, vol. I, 1912, vol. II, 1916; A. D. Morse, *Parties and Party Leaders*, 1923; K. H. Porter, ed., *National Party Platforms, 1840-1924*, 1924; E. E. Robinson, *The Evolution of American Political Parties*, 1924; F. R. Kent, *The Democratic Party*, 1928.

DEMOCRATIC-REPUBLICAN, or REPUBLICAN, PARTY, in United States history, 1789-1824, the political party associated with Thomas Jefferson and with strict construction of the constitution in the interests of political democracy. Most ANTI-FEDERALISTS after the adoption of the Consti-

tution were STRICT CONSTRUCTIONISTS, advocates of States' Rights opposed to Alexander Hamilton's Federalist measures (see **FEDERALISTS**) for strengthening the National Government. Under Thomas Jefferson's leadership the opposition groups were coalesced into a political organization. As the American population was in spirit essentially democratic, the party was by 1800 sufficiently strong to vanquish the vested property interests represented by the Federalist party. The broad principles of the Democratic-Republican party have become known as **JEFFERSONIAN DEMOCRACY**. In general the party represented the agricultural masses against the urban classes; the "common people" against property owners, creditors and the commercial classes; State's Rights; and, correlative of its democratic bias, sympathy for the French as against the English. During Jefferson's administration, 1801-09, the party became firmly entrenched. After Rufus King's insignificant showing in the presidential election of 1816, the Federalist party disappeared. Without an opposition party the Democratic-Republicans, after a comparatively quiescent period (see **ERA OF GOOD FEELING**) split into factions grouped about the several party leaders: Adams men, Clay men, Calhounites, Crawford men, and Clintonians. The faction led by Jackson clung most tenaciously to the principle of the party under Jefferson, and by 1832 was known as the **DEMOCRATIC PARTY**. The factions led by Clay and John Quincy Adams became the nucleus of the **WHIG PARTY**.

DEMOCRITUS (c. 470 or 460-357 B.C.), Greek philosopher, who lived at Abdera, in Thrace. He is sometimes called the Laughing Philosopher and is the father of systematic materialism. He was a disciple of Leucippus who belonged to the atomistic school. Originally possessed of means, he traveled much and settled in Egypt for a time. He lived to a ripe old age and was regarded by some as insane in his later years. Democritus died in 357 B.C.

According to Democritus the universe is composed of an infinite number of atoms. These atoms are indivisible but are alike in kind. They vary in size, form and weight but are all the same in their chemical composition. They are law abiding, and motion is one of their properties. Knowledge is due to sensation, sensation being a relation between elements. The distinction between primary and secondary qualities and the physical principle of the indestructibility of matter goes back to Democritus.

DEMOGRAPHY, a term which denotes, in its broadest sense, a statistical description of the life of a people. It is concerned with the effects of both physical and social environment upon man and with the biological aspects of population. Its wide scope includes data of the census pertaining to political, economic, social, religious and educational facts, and classifies the population by sex, age, marital status and the like. It includes the registration of births, marriages, divorces, sickness and deaths, usually under governmental direction; the application of statistical methods to these vital facts; anthropometric studies of human

growth, stature and strength; the facts and results of research in human **EUGENICS**; and the description and analysis of mental and physical pathological conditions, both individual and social.

Demography is often restricted in scope to include only the vital facts of birth, marriage, divorce, sickness and death. In this form it is practically identical with vital statistics, which is the application of statistical methods to the analysis and interpretation of these vital facts. This meaning of demography is the one more generally understood in the United States.

Vital statistics requires the classification of the population by the same categories into which mortality and sickness data are subdivided—age, sex, marital status, nativity, nationality and race and occupation and geographic location. Specific rates of mortality and of the occurrence of sickness must be computed for these different categories in order to make accurate comparisons possible and to analyze the data for causal factors. Census facts on population, therefore, are essential for demographic studies. R. E. CH.

DE MOIVRE'S FORMULA, the equation expressing the relationship

$$(\cos x + i \sin x)^n = \cos nx + i \sin nx,$$

where the operator, $i = \sqrt{-1}$. See **COMPLEX NUMBER**.

DEMONEZITIZATION, the official withdrawal of monetary qualities from a coin; as regards a metal, discontinuance of the metal as the standard of the monetary system. When a coin is demonetized it is no longer **LEGAL TENDER** in the payment of debts, nor is it acceptable by the government in payment of taxes or other obligations. Demonetization may apply to foreign coins circulating, with or without legal status, in a country, or to a country's own currency when the government desires to have it discontinued as money. The last foreign coins were demonetized in the United States in 1857. See also **FREE SILVER**.

BIBLIOGRAPHY.—Horace White, *Money and Banking*.

DEMONOLOGY, a vast body of belief, doctrine and custom concerning the kingdom of evil as projected in demons. It goes back to most ancient times; each culture developed some form of worship of gods as friendly, and demons as hostile, to the welfare of man. The principle of good and evil found expression in a belief in a heaven and a hell. The Devil or Satan as the arch-demon of a later, the Christian, period crystallized the belief of a tempter of humankind; witches made a compact with the devil to secure their unholy power. Exorcism is the practice of casting out devils and evil-minded spirits or demons. See **RELIGION** and **WITCHCRAFT**. J. J.

DEMOSTHENES (c. 384-322 B.C.), Athenian orator and statesman. Dreading the day when Hellenic civilization might be trampled under foot by some foreign invader, he sought to awaken his fellow-citizens to a sense of danger. Athens, now shamefully devoid of public spirit, should, he urged, assert her right to be the leader of a federation of

Greek cities dedicated to the cause of maintaining Hellenic independence. This leadership was Athens' due not by material might, but by her unblemished record of generous service to Hellas in hours of national peril. Soon point was given to Demosthenes' warning by the aggression of PHILIP OF MACEDON, who by advance through Thrace and Thessaly to the pass of Thermopylae gave clear indication of his hostile intent. Persisting in his opposition to Philip, even when the latter had been admitted to fellowship with Greece by the AMPHICTYONIC LEAGUES, Demosthenes was the leader of a strong anti-Macedonian party in Greece, directing many eloquent speeches against Philip. His eloquence persuaded Thebes to join Athens in a final heroic but unavailing stand against Philip at Chaeroneia in 338 B.C. During the rest of his life Demosthenes loyally served Athens, helping her recover from the effects of her disastrous struggle with Macedon and winning rich reward in the gratitude of his fellow-citizens. News of the death of ALEXANDER THE GREAT, in 323 B.C., led Greece to attempt to overthrow the yoke of Macedon. When this revolt was crushed Antipater of Macedon demanded the surrender of Demosthenes. Demosthenes escaped and to prevent capture took his own life by poison. Demosthenes has left many speeches which amply justify the opinion of antiquity that he was the greatest orator of Greece. G. M. H.

DEMURRAGE, the detention of a vessel or other conveyances beyond the time allotted to those shipping or receiving the cargo for loading or discharging; also the compensation for such delay. Demurrage is ordinarily specified in the charter-party, or contract of affreightment, which provides a fixed or reasonable time for loading or discharging the vessel and awards a sum of money to the ship owner as liquidated damages for any delay beyond the stated time. Loosely, the term demurrage includes even unliquidated damages for detention.

DEMURRER, in law, a pleading which does not deny the facts alleged but claims that they do not constitute a cause of action. The decision as to the legality of the demurrer rests with the judge alone. Should he sustain it, the case ends, unless the plaintiff is permitted to amend his complaint to conform to the requirements of the law. If the judge overrules the demurrer, judgment is had in favor of the plaintiff, unless the defendant is permitted to put in an answer.

DEMUTH, CHARLES (1883-), American painter, was born at Lancaster, Pa., in 1883. He studied at the Pennsylvania Academy of Fine Arts and in Paris. His *In Vaudeville* and *Aucassin and Nicolette* were exhibited at the Pennsylvania Academy in 1921. Demuth is represented by water colors in the Metropolitan Museum, New York; Chicago Art Institute; Fogg Art Museum, Cambridge, Mass.; the Brooklyn, Cleveland and Rochester Museums; the Phillips Memorial Gallery, Washington; and the Harrison Gallery, Los Angeles Museum.

DENBY, EDWIN (1870-1929), Secretary of the U.S. Navy, was born at Evansville, Ind., Feb. 18,

1870. At 15 he went to China with his father, who was the U.S. minister to that country. Returning to America in 1894, he entered the University of Michigan and graduated there in 1896. He served in the Spanish-American War, and subsequently in the World War, rising from private to the rank of major. In 1903 he was elected to the Michigan House of Representatives, and was a member of the U.S. Congress for three terms, 1905-11. President Harding appointed him Secretary of the Navy in 1920. In the investigation by the Senate Committee in 1924 of the leasing of the Teapot Dome and Elk Hills naval oil reserves, Denby was so criticized for negligence he resigned from the Cabinet. He died at Detroit, Feb. 8, 1929.

DENDRITE, a stone or mineral showing mineral incrustations or inclusions resembling trees, mosses or shrubs. These are not organic fossils, but the CRYSTAL forms sometimes assumed by iron and manganese oxides when deposited from solution. They are similar to the frost patterns on window panes, and are found particularly in limestones and in moss AGATES. Silver, copper and gold occasionally crystallize in dendritic, or branching, tree-like forms.

DENE, a synonymous name for the American Indian groups belonging to the Northern division of the Athapaskan linguistic stock. See CARRIER; TINNEH.

DENEH (*Alpha Cygni*), a star of the first magnitude and the brightest star of CYGNUS, the Swan. It derives its name from the Arabic word for tail. Its distance is probably in excess of 600 light years, and its brightness 10,000 times greater than that of the sun. See STAR: map.

DENGUE, a disease which occurs in epidemic form in tropical and sub-tropical countries and has occurred over large parts of the southern United States. It is known as break-bone fever from the character of the pain, and dandy fever, from the characteristic gait.

The disease is caused by a filtrable virus, present in the blood and is transmitted by the bite of a mosquito, the *Aedes aegypti*.

The attack begins suddenly with high fever, severe headache, extreme pain in the back, in all the joints and muscles, and great prostration. These symptoms last for about three days. Then there is a remission, soon followed by return of the symptoms although with less severity. Skin eruptions usually occur on the fourth or fifth day of the disease. The illness lasts for seven to ten days. Dengue in itself is probably never fatal.

DENIS, ST., bishop of Paris, martyr and patron saint of France, was born in Italy about the beginning of the 3rd century. He is said to have settled near Paris on the Seine, and after some active missionary work was martyred by the native heathen priests. His life, however, is completely involved in legend. His feast day is Oct. 9.

DENISON, a city in Grayson Co., northeastern Texas, situated 80 mi. north of Dallas. Bus lines, the

DENMARK

Area, 16,604 sq. m.
Pop. 3,550,656

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)
Pop.—Thousands

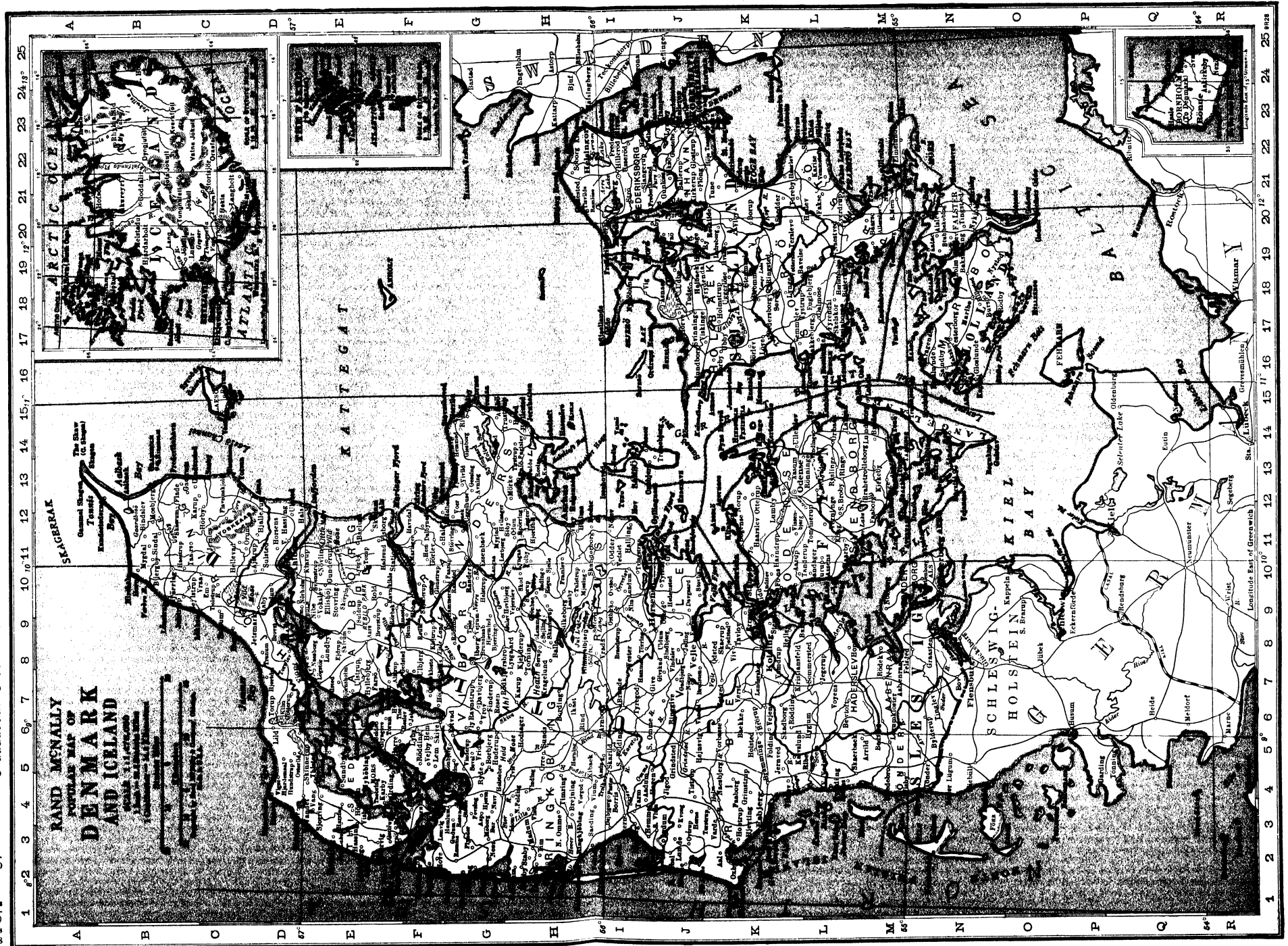
- 9 Aabenraa (Apenrade) M 7
- 44 Aalborg D 10
- 81 Aarhus H 12
- 5 Assens L 10
- 3 Bogenso K 11
- 27 Esbjerg K 3
- 5 Faaborg M 12
- 106 Frederiksberg J 23
- 10 Frederikshavn J 21
- 3 Frederikssund J 13
- 48 Gentofte J 22
- 5 Glostrup J 22
- 5 Grenaa G 15
- 14 Haderslev (Hadersleben) L 8
- 5 Haslev L 20
- 10 Helsingør H 12
- 11 Herning H 5
- 7 Hillerød J 22
- 11 Hjørring B 10
- 6 Holbo F 9
- 12 Holbaek J 19
- 10 Holstebro G 4
- 28 Horsens J 9
- 7 Kalundborg J 16
- 617 København J 23
- 6 Køge K 21
- 22 Kolding K 8
- 10 Korsør F 3
- 5 Lemvig F 3
- 3 Løgstør E 8
- 7 Lyngby J 23
- 5 Maribo L 18
- 7 Middelfart K 10
- 11 Naestved L 20
- 15 Næstved N 16
- 3 Nakso R 24
- 11 Nørresundby D 11
- 10 Nyborg L 15
- 8 Nykøbing E 5
- 4 Nykøbing L 18
- 14 Nykøbing N 20
- 14 Odense L 11
- 57 Odense L 11
- 28 Randers G 10
- 6 Ribe L 5
- 4 Ringkøbing H 3
- 6 Ringsted K 19
- 3 Rødby O 18
- 11 Rønne R 23
- 14 Roskilde J 20
- 4 Rudkøbing N 14
- 3 Saaby C 13
- 12 Silkeborg H 9
- 4 Slagelse L 13
- 4 Skanderborg L 11
- 3 Skovsdr L 17
- 3 Skjern L 13
- 10 Skive F 6
- 11 Sønderborg L 10
- 3 Stoge M 21
- 5 Struer G 4
- 14 Svendborg M 13
- 8 Thisted D 5
- 6 Tønder M 5
- 7 Varde L 10
- 3 Vejle L 10
- 23 Vejle J 8
- 17 Viborg G 8
- 6 Vordingborg M 19

ICELAND

Area, 39,700 sq. m.
Pop. 108,600

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)
Pop.—Thousands
28 Reykjavik C 18



Texas Electric Railway and five railroads serve the city. There is an airport. The chief crops of the district are grain, truck crops and melons. Cotton, cheese and clothing manufacture are the chief industries. In 1929 the value of the manufactures was about \$3,000,000; the retail trade amounted to \$6,657,682. Natural gas is produced in the vicinity. Preston Bend, mentioned in Emerson Hough's novel, *North of 36*, is located near the city. Denison was founded by George Denison in 1871 and incorporated in 1873. Pop. 1920, 17,065; 1930, 13,850.

DENISON UNIVERSITY, at Granville, O., a privately controlled, coeducational institution, was organized by the Baptist Education Society in 1831 as a manual labor school under the name of the Granville Literary and Theological Institution. The manual labor policy was soon abandoned, and in 1856 the present name was adopted. It had productive funds in 1931 amounting to \$2,558,000. Doane Library contains 68,050 volumes. In 1931-32 there was a student enrollment of 843, and a faculty of 66 headed by Pres. Avery Albert Shaw.

DENMARK, a kingdom of Europe, the smallest of the three kingdoms in Scandinavia, situated between 54° 33' and 57° 45' N. lat. and 8° 5' and 12° 49' E. long. It is chiefly comprised of a peninsula of the Central European Plain, running in a northward direction and consisting of Jutland and South Jutland, formerly North Schleswig; the latter territory was taken by Germany in 1864, but was restored to Denmark after the World War. The rest of the kingdom consists of an archipelago of many islands, the chief of which are Zealand, Funen, Laaland, Falster, Langeland, Möen, Samsö, Ærö, Laesö, Taasinge and Anholt in their order of importance, with the big island of Bornholm in the Baltic. There are, however, over 500 other islands, many of which are in the waters between Jutland and Sweden, and of these about 100 are inhabited. Zealand and Funen are connected with the mainland by chain ferries. Jutland is separated from Norway by the Skagerak, from Sweden by the Kattegat and from Germany by the Fehmern Belt. Britain lies across the North Sea 700 mi. to the west. The Danish Archipelago occupies the passage between the Kattegat and the Baltic, and blocks this with the exception of three narrow and comparatively shallow channels, namely the Sound, the Great Belt and the Little Belt. Of the total area of 16,568 sq. mi. the peninsula covers 11,408, and the Baltic islands 5,160.

Physical Features. There is little variety of relief. No point in the kingdom much exceeds 500 ft. This maximum is found near Aarhus, and gives birth to the only considerable river in the country, the Gudenaa, 80 mi. in length, which accounts for the early rise of Randers as a port. In Zealand the maximum elevation is only about 350 ft.; and the lower elevation and the greater distance from the Atlantic combine with proximity to the Sound, near Copenhagen, to make the Faxe hills more famous as a source of cement than as a watershed.

Climate. There is a distinct four-months winter, from Dec. to March, at an average temperature of about 32° F. The three-months summer, from June to Aug., has an average of 59° F. The average rainfall is about 25 in., most falling in the west and least in the lee of the chief heights.

Population. Denmark ranks as one of the well-populated countries of Europe, the number of inhabitants being 3,542,230 in 1930, with an average of 214 per sq. mi. The density of population varies greatly. Thus Zealand, Funen and Langeland have a population of about 300 inhabitants to the sq. mi., while Jutland, because of its vast areas of sandy soil and less fertile land, has a density of about 138. The rural and urban populations are 1,981,995 and 1,560,415 respectively. The Danish people are of the Goth-Germanic race which inhabited the country even in prehistoric times, and their language is universally Danish, though there are dialects, especially in Jutland. The number of foreigners resident in the country is only about 3.27% of the total population. COPENHAGEN, the capital, is responsible for 21% of the total population; Aarhus, 81,517, and Odense, 56,737, are the only other cities of any size. Aarhus is one of the chief railway junctions of the country, for the lake-studded Gudenaa valley, which forms its hinterland, is as important as it is picturesque.

Education. The schools, maintained by local taxation, are free and attendance is compulsory for those between 7 and 14 years old. The Danish people are well educated; there are very fine high schools to continue elementary education, and a large number of colleges take young men and women between 17 and 25 years of age. There are also colleges to teach the best methods of rearing animals and making dairy produce, and scientific work is done to extend knowledge in these matters. The university, founded in 1479, is at Copenhagen. The state church, to which the king must belong, is Lutheran. There are about 3,221,000 Protestants, 22,130 Roman Catholics and 5,940 Jews in the country.

Agriculture and Livestock. Farming and dairying are the principal industries. There is no country in the world where mixed farming and dairying are carried on with more scientific skill. The one great advantage in dairy farming which Denmark possesses over her Baltic rivals is the greater length of her summer and the marine curtailment of the winter, thus minimizing the need for indoor feeding of stock and giving a maximum growing time for pasture grasses. Most of the land is freehold and farmed by the owner, about equal quantities being devoted to tillage and pasture. The soil is fertile enough to foster the dense population, while the climate allows this fertility to be used for products useful in the dairy industry, such as oats, barley, beet-root and potatoes. Livestock provides much raw material for the glove industry of Randers and Copenhagen; but the difficulty of importing feeds and fertilizers during the World War, and the failure of unmanured crops, caused a reduction of 500,000 cattle,

or 20%, 2,000,000 pigs, or 80% and 6,000,000 poultry, or 40%. The export of animal products did not reach the pre-war level until 1924.

Reclamation. In olden days the oak was the typical tree in Jutland, but the supply seems to have been exhausted for shipbuilding. In the process of natural reforestation, soil and climate were more favorable to the beech than the oak; and probably the demand for a domestic wood and charcoal favored the beech. In the meantime the destruction of the old forests had exposed the western parts of the country to encroachment by wind-blown sand, thus impoverishing still more a land of bog and moor. Within recent years all these adverse conditions have been fought successfully. The sands have been planted with mountain pine and red fir, the windiest exposures have been isolated by scrub fences, the bogs have been drained and the moors have been fertilized by top-dressings of marl. The total result may be summed up by the statement that the old deserts have been growing in population faster than any other part of the kingdom.

Fisheries. Reclamation has resulted in the lessening importance of the local fishing industries. Many of the fishermen have taken to farming, and fisheries have tended to lose their local character, and be chiefly carried on by sea-going auxiliary motor cutters numbering about 2,000. The long North Sea western coast of Jutland, almost unapproachable, has only one suitable harbor, that of Esbjerg. Esbjerg is the home of a large fleet of fishing vessels, and is a port growing in size and importance from the fact that it is the nearest point to England from which Copenhagen can be reached by traveling across Denmark.

Industry and Trade. The principal manufactures are furniture, porcelain and clothing. The lack of coal is a handicap to industries. The leading imports are coal, maize and oil cake. The exports are dairy produce, live pigs, cattle and beef. Butter, eggs and bacon account for more than half the exports.

Government. The constitution gives legislative authority to the crown and parliament jointly; the crown has the executive power and the courts administer justice. The parliament, called the Rigsdag, consists of two chambers: the *Landsting*, or senate, and the *Folketing*, or lower house. The members of the Landsting are elected indirectly for a period of eight years, but half the members vacate their seats at the end of four years, and 19 other members are elected by the senate. The 149 members of the Folketing are elected for four years. The FAROE ISLANDS are administratively a part of Denmark. Greenland is a colony and ICELAND a sovereign state in union with Denmark. The king of Denmark is also king of Iceland.

DENMARK, HISTORY OF. As in the case of the other northern states, little is known about Denmark and its population before the 9th century when the Viking Age began. This period lasted till the 11th century and was marked by considerable extension of

Danish rule and influence. The establishment in 878 of the Danelaw in England illustrated one of its early consequences. In the 11th century, Sweyn Forkbeard, c. 985-1014, and Canute the Great, 1014-35, ruled over most of Scandinavia and a large part of England. This far-flung domain was dissolved a few decades later, however, and subsequent efforts to revive it failed.

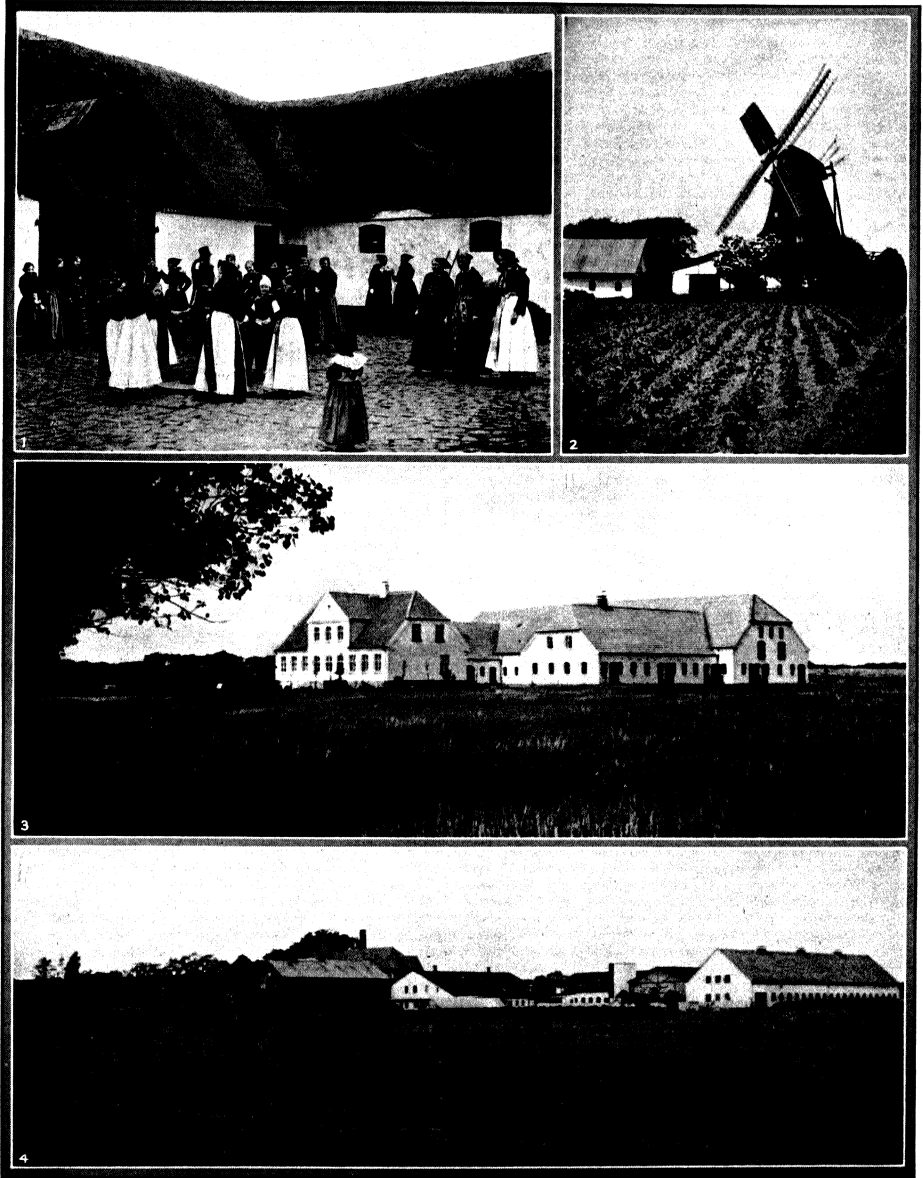
Christianity was introduced beginning in 827, and the new religion was fairly well established by the 11th century. The Church grew rapidly in power and influence, especially after Canute the Holy (d. 1086) raised the clergy to a position of complete equality with the higher nobles, and freed them from the jurisdiction of secular law and courts.

The collapse of the Danish empire in the west was followed by a period of successful conquests to the east, along the southern littoral of the Baltic. Waldemar the Great, 1157-82, who became sole ruler after prolonged internal strife, began the expansion. Waldemar Sejr, "Victorious," 1202-41, extended it, 1219, to Estonia, the Christianization of whose inhabitants was thus begun. These territorial gains were also lost, in part, before long. After experiencing considerable difficulty in holding these eastern lands, Estonia was sold to the Teutonic Knights in 1346. Throughout most of the century 1240-1340 Denmark was torn by a contest which involved the Crown, the nobles and the Church. Among its important consequences were the threatened dissolution of the kingdom, the appearance of a real privileged nobility, and a lowering of the position of the peasantry which was bound fast to the soil.

Broad Expansion. During the rule of Waldemar Atterdag, 1340-75, the trend toward internal union and consolidation became marked again. Scania, which had been lost to Sweden, was recovered; Gottland was taken; and the commercial supremacy of the Hanseatics was strenuously combatted. Waldemar's daughter Margaret, Regent 1376-1412, married King Haakon of Norway. After Haakon's death, 1380, Margaret united Denmark and Norway under her infant son Olaf. By assisting the Swedes in the contest against Albrecht of Mecklenburg, she won Sweden also, 1389, and prepared the way for the election of her nephew Eric, 1396-1439, as King of the three countries. The KALMAR UNION thus established failed to weld the north into one kingdom. Eric himself was ultimately deposed. The later union monarchs became increasingly Danish, especially after the establishment, 1443, of the permanent royal residence in Copenhagen. Local jealousies, the conflicting ambitions of the leading nobles and other factors contributed to the final dissolution of the union in 1521 when Sweden revolted under the leadership of Gustavus Vasa. The then King of Denmark, Christian II, 1513-23, was deposed as a consequence of his unsuccessful efforts to maintain the union and to break the power of the pretentious nobles and the clergy. However, Norway still remained under the Danish Crown.

Lutheranism was introduced during the reign of

DENMARK

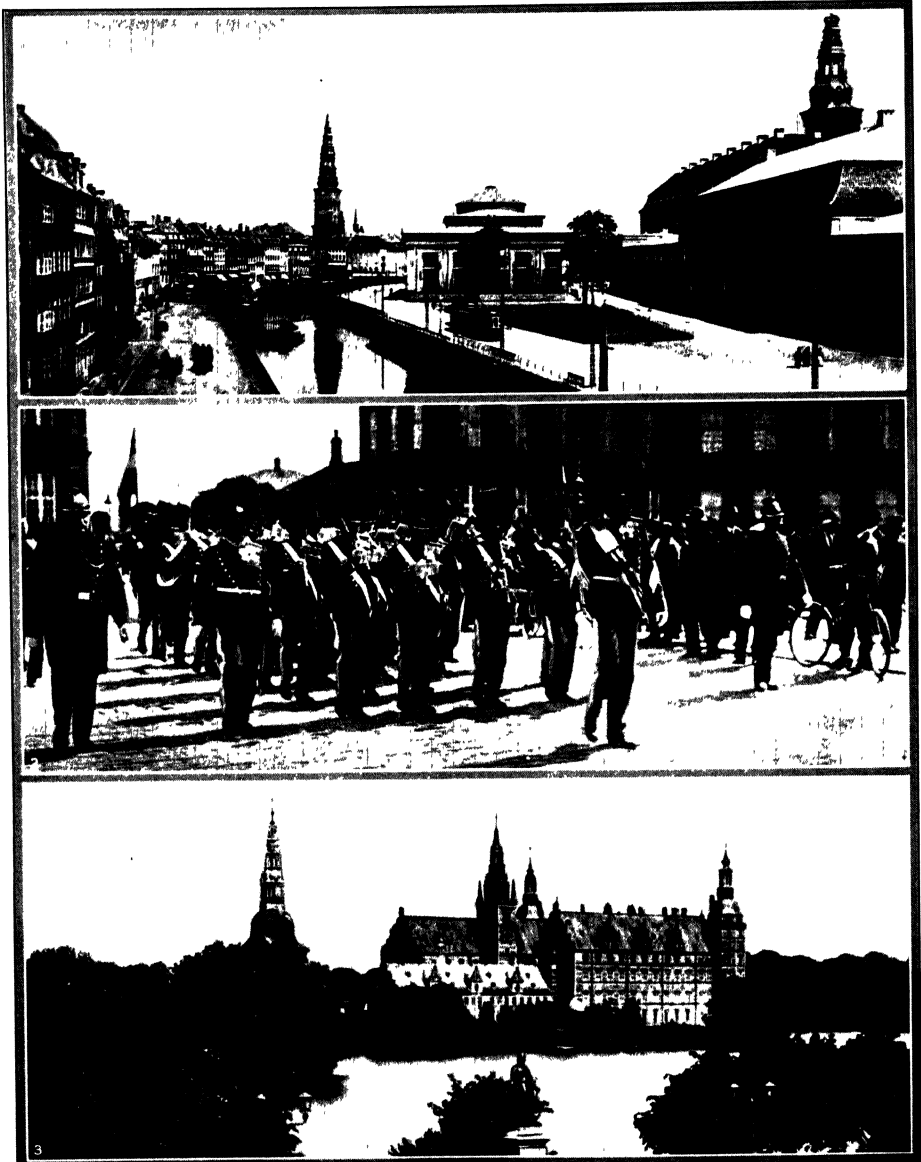


COURTESY DANISH STATE RAILWAYS

OLD AND NEW IN THE DANISH COUNTRYSIDE

1. Folk festival, Island of Amager, near Copenhagen. 2. A windmill on the island of Aero. 3. Main buildings of a modern country estate. 4. Cattle and buildings of the Dalum Agricultural School.

DENMARK



COURTESY SCANDINAVIAN TRAVEL BUREAU

COPENHAGEN—PICTURESQUE CAPITAL OF DENMARK

1. One of the many canals winding through the city. The tower to the right surmounts the Danish Parliament. The square building in the center is Thorvaldsen's Museum.

2. Band of the Danish Royal Guard. 3. Frederiksborg Palace outside the city, now a national museum. It was built by King Christian IV early in the 17th century.

Frederick I, 1523-33, and was firmly established under Christian III, 1534-59. In the breach with Rome, the Crown played a decisive part, and it likewise contributed much to the upward swing of Danish trade and commerce, and the enhanced prestige in foreign relations, which became marked during the second half of the century. But the power of the leading nobles grew also, especially after the elimination of the bishops, 1536, left them as the only important privileged group. Their influence was further enhanced by the elimination, after 1570, of peasant representation in the Rigsdag. During the reign of Christian IV, 1588-1648, they were strong enough to frustrate the efforts made by the King to improve the position of the downtrodden peasants.

Denmark participated in the THIRTY YEARS' WAR on the side of the enemies of the Emperor, and ultimately became embroiled with Sweden. It fell to the lot of Frederick III, 1648-70, to cede to Sweden considerable territories, in the Peace of Roskilde, 1658, and the Peace of Copenhagen, 1660, which gave the latter natural geographical boundaries to the south.

These reverses and matters connected with them enabled the Crown to assert itself at the expense of the privileged classes. Aided by the discontented clergy and commoners, Frederick was able to establish a hereditary monarchy and undisguised absolutism, 1665. The later efforts to regain the territory lost to Sweden were unsuccessful, and Denmark's participation in the Northern War, 1700-21, only led to the beginning of Danish dependence on Russia in foreign affairs. The growing power of the Crown likewise failed to improve the condition of the peasants. Serfdom continued to spread during the 18th century until much-needed reforms were begun under Crown Prince Frederick, who became the ruler of the country in 1784.

Constitution of 1863. Denmark was drawn into new difficulties by the Napoleonic Wars. Participation in the Armed Neutrality of 1800 led to trouble with England which culminated in the bombardment of Copenhagen and the capture of the entire Danish fleet, 1807. The opposition to England and the consequent support of France led in 1814 to the loss of Norway to Sweden. Another serious reverse was met with later in the 19th century, in the solution of the Schleswig-Holstein question which reached an acute stage in 1848. The Danish attempt to completely incorporate the duchies into the kingdom led in 1852 to an international conference at London, at which provision was made for a purely personal union between the kingdom and the duchies. In 1863 the Danes obtained a new Constitution which, contrary to the London agreement, unified the political institutions of Denmark and the duchies. The result was a brief war, fought in 1864 against Prussia and Austria, which ended with a treaty whereby Christian IX renounced his rights to the disputed territories. North Schleswig was recovered from Germany after the close of the World War.

The Constitution of 1863 had important internal

consequences as well. By 1872 more than half of the seats in the lower house were in the hands of the Left, one of whose objectives was responsible government. The conservative Estrup ministry, 1875-94, fought long for the right of the king to appoint his ministers, and governed by decree for several years. The first ministry of the Left assumed office in 1901. The Christensen ministry, 1905-08, placed much progressive legislation on the statute books. In 1915 long-continued efforts to revise the fundamental law led to the liberalized Constitution of that year which went into effect in 1920. During the World War, Denmark cooperated with the other northern states in the maintenance of neutrality, sold the Danish West Indies to the United States, 1917, and granted full independence to Iceland, in personal union with Denmark, in 1918.

Disarmament Problems. The Constitution of 1915 gave the right to vote to all Danes over 25 years of age. The lower house (*Folketing*) is composed of 152 members and is chosen for four years. The upper house (*Landsting*) of 78 is elected for eight years and is popularly chosen only in part, in that 19 are selected by the lower house, and the remainder by citizens of 35 years of age or over. Parliamentary Government has been a fact since 1908-10, but was recognized by law only in 1915. Among the important questions of policy since that year has been the problem of armament. Considerable reductions in military and naval expenditures were effected in 1922. The Stauning Socialist ministry, which came into office in 1929, has labored hard for complete disarmament, on the theory that Denmark, being predominantly agricultural, dependent upon foreign markets, and lacking the means necessary for adequate defense, should adopt a policy of complete disarmament because it is both sensible and economically sound.

J. H. Wu.

BIBLIOGRAPHY.—R. N. Bain, *Scandinavia, a Political History of Denmark, Norway and Sweden from 1513 to 1900*, 1905; L. M. Larson, *Canute the Great*, 1912; J. Stefansson, *Denmark and Sweden with Iceland and Finland*, 1916; W. J. Harvey and C. Reppien, *Denmark and the Danes*, 1916; F. C. Howe, *Denmark, a Cooperative Commonwealth*, 1921; H. Jones, *Modern Denmark*, 1927.

DENSITY, the mass, M , per unit volume, V , of a body. This is expressed by the equation, $D = M/V$, where D is the density. Usually, the mass of the body is obtained by means of a sensitive analytical BALANCE. Corrections are made for the buoyancy of the air, so that weighings are made as though they were carried out in a vacuum. The volume may be determined by measurements with calipers if it is a regularly shaped body. Whether it is regularly or irregularly shaped, the volume is conveniently obtained by submersion in a liquid. ARCHIMEDES showed that a body is buoyed up by a force just equal to the weight of the liquid displaced. Furthermore, the unit of mass in the METRIC SYSTEM, the gram, is very closely equal to the weight of one cu. cm. of water. Hence, if a body is submerged in water, the loss in weight which it appears to have by being buoyed up by the water

will be just equal numerically to its volume. Thus, having both the mass and the volume of the body, its density is the ratio of the two.

The *specific gravity* of a body is the ratio of the masses of equal volumes of the body and of water. Inasmuch as density is the mass of a body per unit of volume, one may define the specific gravity of a body as the ratio of the density of the body to the density of water. In the metric system, the density and the specific gravity are numerically equal, because the density of water is unity. In the English system, the density of water is 62.4 lbs. per cu. ft. The specific gravity in the English system is the same as in the metric, but the densities have different numerical values in the two systems. S. R. W.

DENTAL DISEASES. See **TEETH**; **PYORRHEA**; **MOUTH**.

DENTAL PREPARATIONS, commercial products used to cleanse and whiten the teeth, to keep the gums healthy and to prevent diseases from attacking the oral cavity. Preparations used for these purposes may be divided into: (1) *cleansers*, including pastes, powders, and liquids; (2) *mouth washes*, used chiefly to refresh and deodorize the oral cavity. Antiseptic properties are sometimes claimed for mouth washes but this effect is of course very temporary. Full strength application may result in the destruction of bacteria, but this is a medical consideration, and in practical application, mouth washes are used diluted.

Tooth pastes are by far the most popular form of dentifrice. The basic ingredients consist of a powder, such as precipitated chalk, prepared chalk, calcium phosphate, orris root, etc., soap, flavoring and an excipient such as glycerine, honey, simple syrup. Tooth paste is put up in tubes, and because it has a tendency to harden, this is considered one of the chief manufacturing difficulties.

Tooth powders are now probably used more in Europe than in America. The basic ingredients used are precipitated chalk, prepared chalk (amorphous), calcium phosphate, orris root powder, Kieselguhr, Kaolin, etc., and a flavoring. As in the case of tooth pastes, there is an infinite variety of formulae with only slight differences in basic substances.

Liquid dentifrice is the least popular in America. It is a foamy or saponaceous liquid used as a tooth cleanser or mouth wash, flavored to taste pleasantly with such ingredients as cinnamon oil, orange flower water, clove oil, oil of eucalyptus, etc., with coloring matter added. Antiseptic properties are derived from salol, boric acid, borax, phenol and thymol.

G. R. F.

DENTIL, one of a series of rectangular blocks arranged parallel and close together to decorate a band or the underside of a cornice. Dentils are probably the decorative descendants of the structural forms arising from the ends of small cross roof beams, supported on a wall or a cross girder and projecting slightly beyond it. The dentil was first developed in Asia and Asia Minor; Persian palaces and Lycian rock cut tombs show representations of its wooden origin. In

the 5th century B.C. dentils were used generally in the *BEDMOLD* of the cornice of the Ionic order, and during the Roman and Renaissance times were widely used for the Corinthian and Composite orders as well.

DENTIST, one who treats defects of the teeth (operative or surgical dentistry), or who makes and inserts artificial teeth (prosthetic dentistry). To-day a dentist is required to pursue one year of college work and then must have had four years of work in a dental school. See **DENTISTRY**, **SCHOOLS OF**.



COURTESY P. & P. CAPRONI BROS.
DENTIL FROM THE CORNICE
OF THE ERECHTHEUM, ATHENS

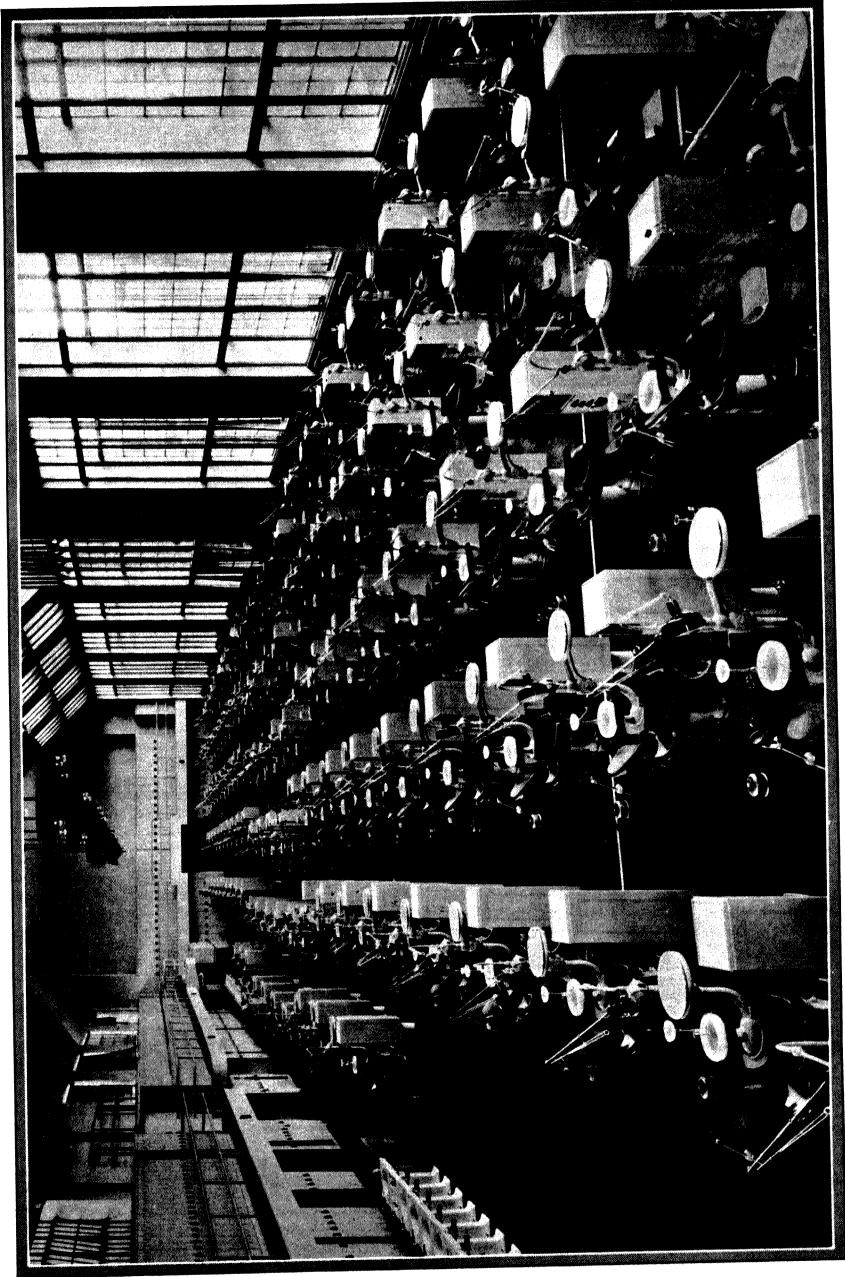
Dentistry in its cruder forms has been practiced since the times of the early Egyptians. Its present effective organization as a profession is largely a product of the twentieth century. Before 1900 the often poorly-equipped itinerant dentist, traveling from town to town, was too often typical of the profession. At present, a graduate dentist either establishes his own office at a considerable cost or works with an already established dentist as an assistant or partner, content for several years with a meager return on the cost of his education.

DENTISTRY, that branch of science which embraces a knowledge of the anatomy, physiology and pathology, and the therapeutic, surgical, and mechanical treatment of the tissues of the mouth and the teeth together with an intimate comprehension of their disturbances relative to the body as a whole. It also comprises a knowledge of the materials used and their manipulation in the restoration of dental and oral defects.

The special training which is required for the successful practice of dentistry is primarily concerned with the development of manual dexterity. As the medical schools would not provide the necessary facilities for the training in the mechanical procedures of the dental art, the establishment of independent dental colleges was the direct sequence. The increase in knowledge of diseases of the mouth and its contained organs and the increasing recognition of the vital relationship of the oral tissues to the body as a whole, have gradually broadened out the scope of dental education, until at present all the fundamental sciences are included in the curricula of the best dental colleges.

The development of dentistry in the United States, since its inception in 1839, has been phenomenal; it occurred more or less simultaneously with the foundation of the first dental college in the world, the Baltimore College of Dental Surgery, the organization of the first dental society, the American Society of Dental Surgeons, and the publication of the first dental periodical of this or any other country, the *American Journal of Dental Science*. The incorporation of the systematic teaching of mechanical dentistry in the college course, instead of depending upon the uncertain educational results of an apprenticeship sys-

DENTISTRY



A MODERN DENTAL CLINIC

The Operative Clinic of the Thomas W. Evans Museum and Dental Institute of the School of Dentistry of the University of Pennsylvania, Philadelphia. One of the largest rooms of its kind, the clinic contains 132 units (operating chairs and instrument cabinets) and is equipped to treat an average of 200 patients a day.

tem, has had greatly to do with creating a body of American practitioners skilled in their art. It is, in fact, for his skill as an operator that the American dentist has been mainly distinguished the world over. By reason of his special fitness, as obtained by our present dental educational system, the dentist is best suited for the treatment of the diseases of the teeth and their adnexa, and the oral cavity and its contained organs are his chosen field.

The replacing of lost portions of a normal tooth crown by a gold filling has been developed into a fine art; it may be accomplished by a hammered foil filling or, as it is very largely practiced at present, by a cast gold inlay, which was introduced by Dr. W. H. Taggart, of Chicago, in 1905. To avoid the display of elaborate operations of gold, especially in conspicuous positions in the front teeth, aesthetic considerations have stimulated the search for some substitutes more in harmony with the texture and color of human teeth. Porcelain as a restorative material is at present utilized most successfully for such purposes, especially in conspicuous situations. Silicate cement fillings, which have been introduced within recent years as substitutes of gold or porcelain in the restoration of decayed portions of the anterior teeth, must be classified as limited in their duration. Certain other plastic materials that have the property of becoming hard in the course of time after having been inserted in a soft state, are also extensively employed. This class of materials includes the amalgams, oxyphosphate cements and, to some extent, gutta-percha. Cements and gutta-percha fillings serve only a temporary purpose, and their usefulness is therefore of limited duration. The amalgams, on the other hand, while unsightly in appearance, are extremely useful, as well as less costly; they are quite durable and capable of insertion without difficulty and they may be used in case of extensive decay of tooth structure.

The advances made in the treatment of pulpless teeth have made possible the more or less permanent saving of multitudes of teeth in a condition of comfort and functional usefulness which were previously inevitably sacrificed or lost.

Investigations in the domain of oral pathology have thrown much light upon the causes and the modes of treatment of the diseases of the retaining tissues of the teeth (e.g., *PYORRHEA ALVEOLARIS*), which, when unchecked, result in their early loss by destruction of their attachment to the gums and the alveolar sockets. The grafting of artificial crowns of porcelain upon healthy natural roots is accomplished in a large variety of ways, the attachment being by metallic dowels cemented into the properly enlarged pulp canal of the root; this being in most cases reinforced by means of a gold ferrule connected with the porcelain crown, closely encircling the periphery of the root at the gum margin.

In connection with the general use of filling materials, certain ingenious devices came into existence as adjuncts to tooth-filling. These were the dental

engine, the mallet and the rubber coffer-dam. The operation of preparing the cavity for the reception of gold involves the removal of decayed portions and frail margins, and giving to the cavity a retentive shape, so that the filling when inserted shall be solidly and immovably held in place. The early methods of cavity preparation were laboriously performed by small chisels and other hand instruments. The introduction of the dental engine run by foot-power or by electric motor has not only greatly facilitated the operation of tooth-filling, but has made possible more accurate and perfect results. The dental engine and its accessory appliances may be used for every step of the operation.

The department of mechanical or prosthetic dentistry comprises all those operations and the laboratory manipulation of the materials involved in the construction of the substitutes for lost dental organs and parts of the oral tissues. The base-plate may be constructed of vulcanite or of some modern synthetic substitute or of metal. Metallic plates serving as the base of support of artificial teeth are made of gold, aluminum and, recently, of stainless steel; they are constructed by swaging the flat plate cut approximately to the desired pattern between metallic dies, which have been obtained by casting the die into a sand matrix made from the plaster-of-Paris model of the alveolar arches. Dentures upon an enameled platinum base-plate constitute a form of work known as continuous gum work. Porcelain paste or "body," as it is technically called, is packed around the roots and between the artificial teeth; then carved into form and subjected to high heat in a muffle until vitrified. It is finished by being given a coating of enamel in imitation of the natural gum color.

The prosthetic department includes the construction of obturators for the correction of palatal defects, of splints to be used in the treatment of fractures of the jaws and the restoration of parts of the jaws lost by accident or disease, etc. The correction of irregularities in the position of the teeth has developed into a distinct specialty of modern dental practice, termed orthodontics; its importance is due not only to the cosmetic value of its results, but because of the direct bearing of dental irregularities upon the bodily health. Late researches have shown that the mouth, its tissues and secretions, and the teeth themselves, furnish important diagnostic indications of certain bodily diseases. The training of the dental practitioner has, therefore, been enlarged so that in the foundation elements it is now coextensive with that of the practitioner of general medicine.

At present there are about 48 institutions in the United States and its possessions engaged in the exclusive teaching of the science and art of dentistry. Some of these institutions are partially correlated departments of universities, some are conducted as private schools. The present dental curriculum consists of four annual sessions, in four consecutive academic years. The courses in dentistry are open to women on the same terms as to men. The preliminary edu-

cational requirement for matriculation in all schools is the completion of one year of instruction in an approved college of liberal arts and science after the completion of an approved four-year high school course or its equivalent. (In some of the states the requirements vary somewhat.) After the satisfactory completion of the course of study the student receives his degree. This degree in most institutions is designated as Doctor of Dental Surgery (D.D.S.), while a very few (Harvard, Minnesota, etc.) confer the degree of Doctor of Dental Medicine (D.M.D.).

The practice of dentistry is regulated separately by each political division of the United States; examining or licensing boards look after the enforcement of the respective laws. Interchange of licenses is practiced by a few States. There are approximately 68,000 registered dentists at present in the United States. The dental profession of the United States, in harmony with other professional callings, has formed numerous associations for the promotion of scientific intercourse, among which the National Dental Association, the respective State dental associations and many city and county dental societies are most influential bodies. The dissemination of useful professional knowledge is readily accomplished through numerous current periodicals, of which more than fifty appear in the United States. The Army and Navy Dental Departments, the Public Health Service and the U.S. Veterans Bureau offer excellent opportunities to the recent graduates. In addition, industrial dentistry, i.e., dental service rendered by large industrial plants, and dental internships in hospitals offer additional desirable positions.

Aside from the regular dental courses instruction is at present offered in the United States by about sixteen institutions for the training of dental hygienists. The field of the dental hygienist comprehends two general divisions: the teaching of mouth hygiene and the relation of diet thereto, in public and private schools and in public health work; and the prophylactic treatment of the teeth of patients in hospitals, public institutions and in private dental offices under the supervision of a licensed dentist. Requirements for admission to the course in Oral Hygiene is an approved four-year high school course or the equivalent; the course is open only to women. H. P.

BIBLIOGRAPHY.—C. R. Turner, and L. P. Anthony, *American Text Book of Prosthetic Dentistry*, 1928; M. L. Ward, *American Text Book of Operative Dentistry*, 1926; H. Prinz, *Diseases of the Soft Structures of the Teeth*, 1928; H. Prinz, *Dental Formulary*, 1930.

DENTISTRY, SCHOOLS OF. Until 1839 dentists in the United States received their training entirely as apprentices to those already in the profession. The early attempts to establish chairs in dentistry in medical departments in universities met with such antagonism on the part of medical faculties that it was found necessary to develop dental education as an entirely separate branch. Horace Hayden in 1837-38 gave a series of lectures on dentistry to medical students at the University of Maryland but with so much opposition that the next year he with others

established the Baltimore College of Dental Surgery, the first dental college in the world. In 1845 the Ohio College of Dental Surgery was founded. These were followed by the Pennsylvania College of Dental Surgery in 1856 and the Philadelphia Dental College in 1863. In 1867 Harvard opened a department of dentistry.

By 1868, the year that three states passed laws requiring dental education for a license to practice, there were only 10 dental schools or colleges and less than 100 graduates. In 1900, when every state required graduation from a dental school, there were 56 schools, with 7,633 students. The educational requirements for admission to these schools were very low, ranging from no requirement to two years of high school work in 1900. Continued efforts have been made by the National Association of Dental Faculties to raise the educational standards of dentists. In 1930 there were very few graduates from dental schools who had not had at least one year of preliminary college work. M. R.

See William J. Gies, "Dental Schools" in Carnegie Foundation for Advancement of Teaching, *Bulletin*, 1926, No. 19.

DENTON, county seat of Denton Co., Texas, located 38 mi. northwest of Dallas and 35 mi. northeast of Ft. Worth. An airport, bus lines, and two railroads serve the city. All kinds of farm produce including cotton, corn, oats and wheat are produced in the vicinity. Flour and brick-making are the chief local industries. Texas State College for Women and North Texas State Teachers College are located here. Near the city is the North Texas State Experimental Station. Denton was founded in 1857, first incorporated in 1866 and later reincorporated in 1873. Lake Dallas, a large artificial lake, with 35 miles of shoreline, is located 4 mi. east of the city. Pop. 1920, 7,626; 1930, 9,587.

DENVER, the capital and largest city of Colorado, and the county seat of Denver Co., situated in the north central part of the state at the junction of the South Platte River and Cherry Creek. It is one of the important railroad centers of the West, with seven trunk railroads and several branch lines entering the city. Additional transportation is afforded by bus and truck lines and four airports, which furnish transcontinental passenger and air-mail service.

The city is distinctively residential in character. Situated at an altitude of exactly one mile above sea level, within 12 mi. of the base of the Rocky Mountains, and favored by a mild, equable climate and remarkable clarity of atmosphere, Denver is a noted health resort.

Denver is also the outstanding industrial and distributing center of the Rocky Mountain states. In 1929 the total value of its diversified manufactures amounted to \$144,664,746. The principal industrial establishments were meat-packing plants, machine shops, printing and publishing plants, dairies, bakeries, canneries, automobile, mining machinery and rubber goods factories. The wholesaling establishments, 510 in number, did an aggregate business of \$212,150,339;

the 4,478 retail stores, which sold \$224,370,321 worth of merchandise, gave full-time employment to 19,679 people. Denver is also an important insurance center, and 62 Federal bureaus are located in the city.

Denver University, Regis College, Colorado Women's College, Colorado University School of Medicine and Iliff School of Theology give Denver leadership in educational activity.

Originally settled in 1858, Denver was organized in 1860, incorporated in 1862 and made capital of the Colorado territory in 1868. In 1881, five years after Colorado was admitted as a state, the choice of Denver as the state capital was confirmed by popular vote. Pop. 1920, 256,491; 1930, 287,861.

DENVER, UNIVERSITY OF, at Denver, Col., a coeducational and privately controlled institution affiliated with the Methodist Episcopal Church. Chartered in 1864 as the Colorado Seminary, the institution was reorganized in 1880 as the University of Denver. In 1885 the university organized the first Manual Training School in the Rocky Mountain country and maintained it until the high schools of the city opened similar departments. The university comprises a College of Liberal Arts, Graduate School, City College, Foundation for the Advancement of Social Sciences, schools of Law, Commerce, Science and Engineering and Librarianship. It had productive funds in 1931 totaling \$2,129,813. The library contains 63,107 volumes. In 1931-32 there were 2,227 students, and a faculty of 203 headed by Chancellor **FREDERICK M. HUNTER**.

DEODAR (*Cedrus Deodara*), one of the true cedars, a magnificent evergreen tree of the **PINE** family, native to the Himalayas and widely planted as an ornamental in mild climates, especially in England, California, and the Southern States. It is a tree of unusual elegance of form, the massive trunk sometimes rising above 150 ft. in height, with long gracefully drooping branches and dark blue-green foliage. The large reddish-brown cones, which require about three years to ripen, are borne erect on the upper sides of the branches. The resinous, fragrant wood, much prized for carpentry and cabinet-work, is very durable and takes a high polish.

DEODORANTS, preparations used for prevention of body odor. They may be pastes (creams) or powders, and, in the case of oral deodorants, liquids. (See **DENTAL PREPARATIONS**.) Pastes are used usually under the arms to prevent perspiration odor, and powder is generally used for the entire body. Salicylic acid is one of the ingredients suitable for deodorizing.

Perspiration checks are intended to prevent perspiration moisture, as well as odor, especially under the arms where it causes the greatest annoyance. For this purpose there are astringent preparations, usually aluminum chloride solution, that contract the pores, thus preventing moisture from appearing. The use of perspiration checks has greatly increased.

Deodorants act as disinfectants for certain diseases, but in general they differ from disinfectants in that they do not necessarily destroy germs. Many of the

substances in commercial use are combination **DISINFECTANTS** or **ANTISEPTICS** and deodorants. Quicklime, chloride of lime, chlorine, chloride of zinc and nitrate of lead are commonly used deodorants.

DEODORO DA FONSECA, MANUAL (1827-92), the first republican President of Brazil, born in Alagoas on Aug. 5, 1827. In 1843 he entered the Military School of Rio de Janeiro from which he graduated in 1847. Deodoro was quickly promoted, receiving a captaincy in 1856 and the appointment of commandant of the Military School in the same year. In the course of the Paraguayan War he was wounded and promoted several times. Deodoro was made field-marshal in 1885 and was vice-president of Rio Grande do Sul when the military, who were showing republican leanings, clashed with the emperor. Because of his military prestige and republican ideals he was called to lead the republican revolution against the emperor. On Nov. 15, 1889 he seized the chief government buildings in Rio, arrested the emperor and proclaimed a republic on the evening of that day. He became provisional president and, on Feb. 25, 1891, constitutional president. On Nov. 23, he resigned. He died in Rio de Janeiro on Aug. 23, 1892.

DEONA. See **DEVA**; **CHESTER**.

DEOXIDATION, the removal of oxygen from a chemical compound, also called reduction. This may be accomplished by heating the compound with carbon or in a stream of hydrogen gas, so that the oxygen leaves the substance to unite with the carbon or hydrogen for which it has a greater affinity. Deoxidation also occurs in solution.

DEPARTMENT, in French government, the 89 *départements* are the chief administrative subdivisions of France for education, sanitation, agriculture, highways, the public domain, taxation and police. Heading each department, a **PREFECT** appointed by the central government acts locally for all the national ministers concerned. For limited purposes of local self-government the people of the department elect a general council of which the prefect is the executive officer. The prefect appoints many officials such as school teachers, postal employees and the sellers of tobacco and matches. His political influence is likely to be exercised as the cabinet of the day desires.

DEPARTMENT STORE, a store selling many lines of goods at retail in one location. It usually handles as complete lines as possible of many classes of merchandise, such as dry goods, clothing and accessories and home furnishings. It may include many other diverse lines, such as food-stuffs or even automobile accessories. If it confines its merchandise to one class of goods, such as clothing and accessories, it is more properly termed a specialty store.

The department store is so organized that each department is virtually a separate store or specialty shop, having its own management and **ACCOUNTING** systems and being responsible for making a profit. It usually performs such services as delivery of merchandise and maintenance of accounts, and often provides personal services, such as ticket agencies, travel bureaus, in-

formation as to fashions and the like. The largest department stores do an annual volume of business as large as \$100,000,000 and 30 or more department stores throughout the country each have annual sales totaling over \$20,000,000. About 15% of the annual retail business of the country is done by department stores.

Although stores of ten years ago were usually individually owned and managed, there has been an increasing tendency toward AMALGAMATIONS and consolidation into chains. There are now several such groups which have a total annual sales of over \$100,000,000 distributed among four to ten individual stores. E. A. F.

DE PAUL UNIVERSITY, a coeducational institution conducted by the Vincentian Fathers in Chicago, Ill. It was founded in 1898 and has departments of liberal arts, sciences, medicine, engineering, commerce, law, education, music, art, and design, besides extension courses. An academy, a university school for girls, and a summer school are also directed by the university. In 1930 the student enrollment was 7,569, and the faculty of 207 was headed by Pres. F. V. Corcoran.

DEPAUW UNIVERSITY, a coeducational institution at Greencastle, Ind. Chartered in 1837 as Indiana Asbury University, the institution was renamed De Pauw University seven years later in honor of its benefactor. It is privately controlled and affiliated with the Methodist Church. The university maintains a College of Arts and Sciences and a School of Music which confers the degree of Bachelor of Music. It had productive funds in 1931 amounting to \$5,081,145. The library contains 66,046 volumes. In 1931-32 there were 1,601 students and a faculty of 144, headed by Pres. GARFIELD BROMLEY OXNAM.

DEPENDENCY, in sociology, the condition of dependence of a person for financial aid on the community or members of the community.

Poverty is the "failure to maintain a level of living acceptable to the large social group to which one belongs." Such failure may involve cost of goods and services entering into the group's standard of living, nominal income and uses made of income. These in turn may be related to personal traits such as age, sex, race, physical and mental health, occupational skill, habits of work and of consumption. They may be related to make-up of family, or to such general economic conditions as wage scales and regularity of employment. Poverty is most frequently related to sickness, unemployment and old age, over all of which the victim has a minimum of control.

People in poverty may receive assistance from a variety of sources. Throughout human history they have had help from relatives, friends and neighbors. But with the growth of population and mobility it has been necessary to organize relief in parish, lodge, union or municipality. Ecclesiastical charities, private nonsectarian agencies, and departments of public welfare in most American cities may be found. Some of these care for children, some for old people, some

for the sick, some for the homeless and some for family groups. Most of the agencies offer personal service as well as material relief.

BIBLIOGRAPHY—S. A. Queen and D. M. Mann, *Social Pathology*. J. L. Gillin, *Poverty and Dependence*.

DEPENDENCY, in political science, a term denoting a country or a province, often occupied or inhabited by an alien race, that is subject to the control of another state of which it does not form a real part and at whose discretion it is held in political subjection. This control by another state, even if veiled as in the case of protectorates, is the characteristic of a dependency that distinguishes it from an independent or sovereign nation.

DE PERE, a city in Brown Co., eastern Wisconsin, situated on the Fox River, 5 mi. southwest of Green Bay. Bus lines, lake and river craft and two railroads afford transportation. The numerous manufactures include farm implements and machinery, bricks, flour, paper, medicines, knitted goods and boats. There are also foundries and grain elevators. St. Norbert's College is situated in De Pere. Pop. 1920, 5,165; 1930, 5,521.

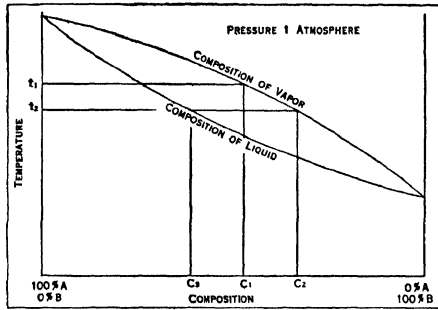
DEPEW, CHAUNCEY MITCHELL (1834-1928), American lawyer and railroad executive, was born at Peekskill, N.Y., Apr. 23, 1834. He was educated at Yale and admitted to the bar in 1858. He was a member of the New York Legislature, 1862-63, and Secretary of State from 1864 to 1865. He became attorney for the New York & Harlem Railroad in 1866, a position which he continued to fill for the newly formed New York Central & Hudson River Railroad in 1869. In 1874 he was appointed director, and in 1875 general counsel, for all the Vanderbilt Lines, and as attorney for these railroads he conducted the complex legal work necessary to effect their consolidation. In 1885 he was made the President of the New York Central, which position he resigned in 1899 upon his election to the United States Senate, serving until 1911. The same year he was appointed Chairman of the Board of Directors of the New York Central System, a position which he held at his death. He was famous as an orator and after-dinner speaker, and delivered many notable addresses, one of the most celebrated being the speech at the unveiling of the Statue of Liberty in New York Harbor. His addresses have been published in 12 volumes. He died in New York City, Apr. 5, 1928.

BIBLIOGRAPHY—His Autobiography, *Memoirs of Eighty Years*, 1922.

DEPEW, an industrial village in Erie Co., western New York, situated 5½ mi. east of Buffalo. It is served by trolley and bus lines and four railroads. The principal local manufactures are locomotives, railroad couplers, storage batteries, food products, brass, silk and felt. The village was founded in 1892 by Chauncey Depew and was incorporated in 1894. Pop. 1920, 5,850; 1930, 6,536.

DEPHLEGMATION, enriching a vapor in its more volatile component by partial condensation (*see*

CONDENSATION OF VAPORS). In the binary system represented in the figure, if vapor of the composition C_1 is cooled from temperature t_1 to temperature t_2 , there results a vapor of composition C_2 and a liquid condensate of composition C_3 . There must be only a small temperature gradient between the vapor and



EQUILIBRIUM DIAGRAM FOR A BINARY SYSTEM

the cooling means if the dephlegmator is to operate in accordance with this theory. If there is a large temperature gradient, the result is simply the complete condensation of a portion of the vapor without change of composition. Industrially, dephlegmators are being superseded by condensers and fractionating columns (see FRACTIONATION).

E. M. B.

DEPILATORIES, instruments or chemicals for removing superfluous hair from the body. Oriental women used *Rhusma* which consisted of a mixture of orpiment (sulphide of Arsenic) and unslaked Lime, both very dangerous. In recent years, due to changes in women's fashions requiring sleeveless dresses and short bathing suits, hair under the arms and hair on the arms and legs is often removed. This may be done with a razor, with waxes or with chemicals. Various authorities state that, of the chemical depilatories, the sulphides (either the alkalis or the alkaline earths) may be used without harm if carefully applied. Depilatory pastes of sodium sulphide are marketed under various trade names and have wide acceptance by women all over the country. The odor of all sulphides is objectionable, although attempts have been made, with limited success, to eliminate the objectionable odor.

DEPLOY, a military term meaning to extend a unit or any of its subdivisions to the front or to separate its elements laterally. All maneuvers of troops in war consist in either deploying columns of march with a view to combat, or playing them into columns for the march. An attacking force begins its deployment gradually, breaking up the large columns into smaller ones and utilizing a greater number of routes of approach. This deployment is so timed that the front line elements are in a suitable formation for opening fire when the approach is completed.

DEPOSITION (DETHRONEMENT). Under the doctrine of legitimacy or the Divine Right of

Kings, a monarch cannot be legally deposed. Even though driven from his throne by revolution he and his successors remain the only legal authority in the state. This doctrine is the basis of the claims of all Pretenders. The Stuart kings sought to establish this principle in English law, but opinion has followed the doctrines of JOHN LOCKE and his defense of revolution and deposition. The dethronement of CHARLES II in 1688 established the supremacy of Parliament over the Throne. This principle is embodied in the Act of Settlement of 1701. The overthrow of numerous monarchies from 1910 to 1931 was accomplished by acts of revolution or by threat of popular force, but in all cases justification for these acts has been sought in decisions of constitutional conventions, representatively elected, to determine the form of the state.

DEPOSITS, in geology, usually has the connotation of material dropped, or deposited, by such transporting agents as water, wind or ice, although this is not always so. Thus it refers to many types of rocks and minerals commonly found at the earth's surface.

For example, the processes of SEDIMENTATION, the dropping of suspended or dissolved material by the transporting water, form the alluvial deposits which build up the fertile flood plains and deltas of rivers like the Mississippi and the Nile. "Alluvial gold" consists of fine particles of gold which have been washed into a stream and deposited with sand and gravel in its bed, forming PLACER deposits. The great mass of SEDIMENTARY ROCKS, sandstones, shales and limestones, were formed as sedimentary deposits of sand, mud and calcareous shells beneath the waters of streams, lakes and shallow seas. Salt and gypsum are also sedimentary deposits, formed by chemical precipitation from solution. Accumulations of wind-transported sand and dust, such as LOESS and dunes, are known as Aeolian deposits. Glacial deposits, known as till, or BOULDER CLAY, consist of boulders, sand and mud dropped by glacial ice. Avalanche material, and piles of rock fragments, or talus, at the base of a cliff receive the name of colluvial deposits.

In the deep sea, to a depth of two or three miles, the deposits are largely organic. They are made up of the remains and shells of tiny plants and animals, and are known as Oozes. At greater depths a red clay covers an area of the ocean bottoms as great as that of all the lands of the earth. In both oozes and red clays are found some land derived materials, such as wind-borne dust, volcanic materials and debris dropped from icebergs, and also particles of iron and dust from meteorites.

Where no transportation is involved, material accumulated in place forms the sedentary deposits, as when WEATHERING produces soils, sands, clays and laterites, known as residual deposits. Accumulated organic material, called cumulose deposits, also belongs in the sedentary group, an example being the formation of Peat in swamps.

The term MINERAL DEPOSIT is applied to a great variety of minerals and rocks which are of commercial

use, irrespective of their mode of origin. COAL deposits, the result of a compaction of peat, and PETROLEUM deposits, the result of the partial decay of organic material trapped in muddy sediments, are evidently true deposits. The class also includes ORE DEPOSITS, however, which consist of local concentrations of metal-bearing minerals within rocks, and which are the result of igneous activity. It is not necessarily a misnomer, however, since ores are frequently deposited in veins by circulating waters.

Materials laid down in the sea are called "marine deposits," the "continental deposits" being those formed by water, wind and ice within the borders of the continents. Along the strand line where sand and ocean meet, the deposits are known as "littoral deposits." See also GEOLOGY; GLACIATION; EROSION.

DEPOSITS, BANK. See BANK DEPOSIT.

DEPOT. See RAILROAD BUILDINGS.

DEPRECIATION, in technical accounting, the loss in value of FIXED ASSETS due to their use in operation or to possession. Depreciation is to be distinguished from depletion, which refers to the loss in value of a wasting ASSET through its exhaustion. The term AMORTIZATION is sometimes used instead of depreciation, where the decrease in value is related to a time contract, as in the case of bond discounts (see BONDS; DISCOUNTS), franchises, and patents.

Depreciation, in this limited sense, usually results either from physical causes, such as wear and tear or decrepitude, or from functional causes, such as obsolescence and inadequacy. The basic purpose of allowing for it is the maintenance of the integrity of invested capital. Thus the cost of the machine worn out in the manufacture of a product constitutes one of the costs of that product and should be compensated for in its selling prices. This depreciation cost should be equitably allocated over the product. A secondary aspect of depreciation relates to valuation. By means of various depreciation reserve accounts a proper valuation of the different depreciating assets is secured.

When an asset is installed its future operating life must be forecast to determine the basis for current estimate. This basis is generally placed on normal operating conditions covering intensity of operations and policy as to repairs. Several methods of calculating periodic depreciation are used, the most common being the straight line method. By this, the full cost of the asset less its estimated scrap value, divided by its estimated service life in periods, gives the amount of periodic depreciation. This is placed on the books as a charge to depreciation expense and a credit to a suitable titled depreciation reserve account. R. B. K.

DEPRESSION, or "Low," a meteorological term meaning an area of low pressure, moving over a large distance over the surface of the earth, technically known as a CYCLONE.

DEPRESSION, BUSINESS. See BUSINESS CYCLES; CRISIS.

DEPTH CHARGES, light, cylindrical metal cases loaded, generally, with about 300 lbs. of cast T.N.T.;

used in attacking SUBMARINES. Sometimes they are thrown short distances by depth-charge projectors, but, more commonly, they are simply dropped over the stern of the attacking ship. The ship dropping them moves safely away while they are descending. When they reach a predetermined depth, they are automatically detonated by pressure-operated firing mechanisms.

DEPUTY CHIEF OF STAFF. See GENERAL STAFF.

DE QUINCEY, THOMAS (1785-1859), English writer, was born at Greenheys, Manchester, Aug. 15, 1785, of an intellectual, well-to-do family. He entered Oxford at 19, after having run away from the Manchester Grammar School to wander about Wales and England for a year and a half. He left Oxford in 1808, but continued in classical studies while he edited *The Westmoreland Gazette* and contributed to the best magazines of the day. For some time he lived in the Lake District, either with or near WORDSWORTH and COLERIDGE. In 1821 he published in the *London Magazine* his *Confessions of an English Opium Eater*, describing the effects upon himself of the drug habit he had contracted while at Oxford; this work brought him fame and has remained his best known piece of writing. In 1828 De Quincey began writing for *Blackwood's Magazine* and moved to Edinburgh, but after the death of his wife in 1837 he settled his children at Lasswade and commenced a wandering life. The range of his knowledge, the extent of his writing and the beauty of his style were not fully appreciated until all his work was collected from the magazines and brought out in a uniform edition, 1852-55. Most of his writing was critical, historical or philosophical. His mind delighted in questions of fine-spun logic. He wrote impassioned prose, believing that an essay should have the measure, proportion and perfect symmetry of a musical composition. Among his works that have remained popular are *Murder Considered As One of the Fine Arts*, *Suspicion de Profundis*, *The English Mail Coach* and *Autobiographical Sketches*. De Quincey died in Edinburgh, Scotland, Dec. 8, 1859. See also ENGLISH LITERATURE.

BIBLIOGRAPHY.—David Masson, *De Quincey*, 1902.

DERAIL, a device for running cars or locomotives off the track when their further movement along the track should be prevented. They are of two general



COURTESY NEW YORK CENTRAL LINES

DERAIL OF SLIDING-BLOCK TYPE, IN DERAILING POSITION

types: the "switch point," which merely leaves one line of rail open; and the metal "block," which is placed on the rail and is so shaped that it carries the wheel, on its flange, over the head of the rail.

DERAIN, ANDRÉ (1880-), French painter, was born at Chatou, June 10, 1880. In youth he turned from engineering to painting, with the encouragement of Maurice de Vlaminck. Meeting MATISSE and Marquet, Derain became prominent in the Fauvist movement (see FAUVISM), but in 1904 broke away to follow a style of his own. He sought to exalt form and color, and his later work showed a strong feeling for composition. Among Derain's principal paintings are *Southern France*, Phillips Memorial Gallery, Washington; *Still Life*, Carnegie Institute, Pittsburgh; *Still Life*, Detroit Institute of Arts; and *The Farm*, Bliss Collection, Museum of Modern Art, New York.

DERBY, EARLS OF, titular heads of the Stanley Family. For eight centuries, the Stanleys have been strongly entrenched as landowners in Lancashire and in the Isle of Man, where at times they have exercised regal powers. During this long period, the earldom, first conferred by King STEPHEN at the Battle of the Standar in 1138, was lost and regained several times. It was Lord Stanley who, at the Battle of Bosworth in 1485, deserted King RICHARD III, assisting Henry Tudor to win a victory and throne. Stanley actually placed the crown of England on Henry's head, receiving the Earldom of Derby as reward.

The seventh Earl, born 1607, mobilized his forces in favor of King CHARLES I. There were sieges of Lathom House and Bolton Castle which the earl owned, and after the defeat of CHARLES II at Worcester in 1651, the earl was executed by Parliamentarians and his estates were forfeited. His successor was bitterly incensed when Charles II vetoed the Bill, passed by both Houses unanimously, which would have restored these vast possessions in full. But the Stanleys, though reduced in influence, remained great landowners and, with the rise of Liverpool and other cities in Lancashire, their wealth increased.

The 14th Earl of Derby was born Mar. 29, 1799. Educated at Eton and Christ Church, Oxford, he won prizes for poetry and qualified himself for translating Homer's *Iliad*, which task he completed in 1864. Described by Bulwer Lytton as "the Rupert of Debate," the young Stanley started as a Liberal, supporting the Reform Bill, abolition of slavery in the West Indies and a reduction in the number of Irish Bishops. But he opposed SIR ROBERT PEEL and Free Trade and so became leader of a Conservative Party of which BENJAMIN DISRAELI was the real inspiration. Succeeding to the earldom in 1851, Derby became Prime Minister three times, in 1852, 1858 and 1867. He died Oct. 23, 1869 at Knowsley, Lancashire.

The present Earl of Derby was born Apr. 4, 1865. He has held many political positions, but, under the pressure of taxation, has been compelled, like other landowners, to dispose of certain estates.

DERBY, the county town of Derbyshire, England, situated on the river Derwent about 128 mi. northwest of London. It is almost at the center of England, and since Saxon times has been the junction of a network of routes. In 1717 John Lombe erected at Derby the first silk mill in England, and in 1773 Arkwright followed with the first calico mills. At that time the city was famed for its ale and its porcelain, the manufacture of which still persists. Modern Derby has numerous public buildings and educational foundations, a fine example of mediæval Perpendicular style in St. Peter's Church, and representations of the Decorated in St. Alkmud's and St. Andrew's. There are silk and elastic web works; paint, shot, varnish and lead factories; sawmills and tanneries. Pop. 1921, 131,351; 1931, 142,406.

DERBY, a city in southwestern Connecticut, New Haven Co., situated at the point where the Housatonic and the Naugatuck rivers meet, 10 mi. west of New Haven, served by the New Haven Railroad. It is one of the important industrial centers of Connecticut, manufacturing clothing, machinery and ammunition. In 1929 the factory output amounted approximately to \$6,000,000; the retail trade reached a total of \$5,843,290. Derby was an Indian trading post in 1642, settled in 1651, and till 1675 was known as Paugasset. The city was chartered in 1893. David Humphreys, Washington's aide, and Isaac Hull, commander of *Old Ironsides*, were born in Derby. The Yale boathouses are located here. Pop. 1920, 11,238; 1930, 10,788.

DE RESZKE, EDOUARD AND JEAN. See RESZKE, EDOUARD AND JEAN DE.

DERMAPTERA, the name for an order of beetle-like insects. Its best-known members are the common earwigs (*Forficulidæ*). They usually have short leathery fore-wings and membranous hind-wings that fold up like fans, but some forms are wingless. Even the winged species seldom fly. Earwigs are fond of dark corners and tiny crevices, in which they hide during the day. The popular idea that they creep into human ears is, however, apocryphal.

DERMATITIS, a term denoting an inflammation of the skin produced by the local action of an external irritant. There are a large number of substances of a physical or chemical nature, of animal, vegetable, or mineral origin, which may in a susceptible individual cause an inflammatory reaction of the skin through contact, exposure or absorption. In typical cases the eruption begins acutely with redness or erythema and swelling of the exposed parts. Later on vesicles or blisters may form which ooze and may cause severe itching and burning. If the dermatitis becomes chronic, there may be scaling and a persistent thickening of the skin. The eruption may at first be limited to the site of the irritation or it may spread widely by absorption, producing what is called a toxic dermatitis.

There are many different types of dermatitis, depending on the cause, location and special characteristics. Seborrheic dermatitis is an inflammatory type

of dandruff, producing red, greasy, scaling patches on the scalp, face, chest and back. Dermatitis venenata is the term usually applied to the reaction produced by the group of external irritants, as plants, dyes, chemicals, cosmetics, antiseptics, etc. Among the plants most apt to cause cutaneous reactions may be mentioned Poison Ivy, poison oak, and sumach, primroses, certain ferns and dozens of other plants. Lacquer dermatitis has been traced to the Japanese lacquer used on mah-jong sets. Hair dyes and dyed furs containing a certain chemical called paraphenylenediamin may cause a severe dermatitis of the face and neck. Cosmetics which contain lead, mercury, bismuth, thallium and other metals are dangerous and cases of poisoning have been traced to this source. Dentists are liable to develop an irritation of the hands due to handling novocaine or cocaine. Physicians and nurses may become sensitized to formalin or mercurial salts.

The term industrial or occupational dermatitis includes a large group of eruptions formerly classified as "trade eczemas." The factors that predispose workers to dermatitis are mechanical irritation, continuous exposure favoring chemical absorption, improper hygiene, poor elimination and lowered resistance from old age, fatigue and worry. Among the occupations which are especially predisposed may be mentioned bakers, grocers, barbers, chemical workers, dyers and dye workers, electroplaters, metal polishers, flax workers, furriers, furniture polishers, printers, washerwomen, photographers and workers in oil, petroleum, paraffin and tar products. The control of these cases includes necessarily a careful study of the habits and contacts of the workers, removal of the cause and frequently a change of occupation.

A special type of dermatitis is that produced by physical agents such as ultra-violet light, X-rays and radium.

The treatment of every case of dermatitis should begin with a careful inquiry into a patient's habits, his home surroundings, the clothing he wears, the occupational factor and all other possible sources of external irritation. The removal of the cause is usually equivalent to a cure. In addition to this, appropriate lotions, wet dressings, ointments and pastes are applied to soothe the inflamed areas and to give relief from the itching. Specific desensitization may be used in the prevention and treatment of POISON IVY and POISON OAK by means of a special antigen. *See also LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE.* E. P. Z.

DERMATOLOGY, that branch of medicine which deals with diseases of the skin. The integument is looked upon as an integral part of the body organism and its diseases are made known by objective symptoms visible to the eye or appreciable to the touch and by subjective symptoms experienced by the patient. In order to interpret correctly the significance of a skin disorder, the physician must have a thorough training in such fundamental subjects as the anatomy and physiology of the skin, etiology, bacteriology and pathology, and both general and spe-

cial methods of treatment, besides a broad clinical training and a knowledge of general medicine and surgery.

Disorders of the skin may be either symptomatic or idiopathic. Examples of the symptomatic class are the eruptive fevers, such as measles, smallpox, and the toxic eruptions that follow the ingestion of certain drugs and foods or that are indicative of some infectious or bacterial agent in the tissues or blood stream. On the other hand, an eruption may be idiopathic or limited to the skin and due to external chemical or mechanical irritation or some occupational or hygienic factor or to local infection by bacteria or fungi, the latter being called parasitic skin diseases.

It is also true that both local and constitutional factors are of importance in the causation of a given skin affection. The most important influences that must be considered in the etiology are climate, age, sex, familial occurrence or heredity, habitat, occupation, season and the presence of any organic or constitutional disease. In recent years a great deal of study has been devoted to the subject of sensitization of the skin, sometimes called ALLERGY, and the reactivity of the skin to various food proteins has been determined by means of skin tests and to external irritants by patch or contact tests. A study of the pathologic or microscopic changes in the skin is an important aid to diagnosis and to the scientific study of the morbid processes taking place in the body.

The diagnosis of a skin disease is based upon a careful systematic examination, preferably of the entire integument in good daylight, and by an analysis of such factors as the distribution, duration, history and character of the lesions, their color grouping, the type of eruption, etc., plus a careful general examination and such special chemical or bacteriologic laboratory studies as may be necessary in each individual case.

The underlying principles of treatment of lesions of the skin do not differ from those employed in the treatment of diseases of other organs. The belief of the public that it is dangerous to cure a skin disease too rapidly is without foundation. In most diseases both local and constitutional measures are employed. The local treatment includes first the use of external remedial measures, such as baths, wet dressings, lotions, powders, salves, pastes, etc. In addition to this there is the important group of physical agents that are being used more and more in the treatment of diseases of the skin. These include: Roentgen or X-rays, radium, ultra-violet light, Finsen light or carbon-arc light, super-soft or Grenz rays, medical and surgical diathermy, the cautery, electrolysis, freezing and local surgical measures.

The constitutional treatment and correction of the diet (*see DIET and DIETETICS*) are of great importance in spite of the fact that there are only a few specific remedies that influence the skin. The complexity of the subject may be appreciated by the fact that there are over two hundred different diseases of the skin with a special and varied nomenclature. Most medical schools have separate departments in

which diseases of the skin are taught, usually also including the important subject of syphilis in the curriculum. In the European clinics skin and venereal diseases are usually taught in one department in state-controlled universities. There are several special hospitals in this country devoted to the care of skin diseases and cancer and most of the larger hospitals have special wards or departments for the treatment of this group of patients. *See also* DIATHERMY; LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE; RADIUM AND RADIUM THERAPY; ROENTGENOLOGY AND ROENTGENOTHERAPY. E. P. Z.

DERMOID CYST. *See* TUMORS.

DERONDA, DANIEL. *See* DANIEL DERONDA.

DERRICKS, as used on vessels, consist of wood or steel booms (two or four) pivoted at the lower end of a mast or king post, and connected by ropes to the upper. They are served by winches or hoisting engines, which, through ropes to the booms, lift cargo from a wharf or a lighter, swing it over a ship's hatch, where it is lowered into the hold. *See also* CRANES.

DERRY. *See* LONDONDERRY.

DERRY, a town of southeastern New Hampshire, in Rockingham Co. It is situated about 12 mi. southeast of Manchester and is served by the Boston and Maine Railroad. Surrounded by a rolling agricultural and dairying region, Derry is a popular summer resort. The manufactures include shoes, wooden heels, mattress-facing and witch hazel. Milk and garden truck are shipped to Boston. Derry was founded in 1719 and incorporated in 1827. Pop. 1920, 5,382; 1930, 5,131.

DE RUYTER, MICHAEL ADRIANSZON (1607-76), Dutch naval officer, was born at Flushing, Mar. 24, 1607. His life was a continuous record of warfare. He assisted Admiral Tromp in his successful expedition against England in 1652. He fought pirates, captured Turkish vessels in the Mediterranean, rescued Christians from infidel slave-ships. In 1659 he joined Denmark against the Swedes. He fought against Spain, and later came to her aid. He fought England alone, and England leagued with France. When he was almost 70, off Messina, Sicily, he received a mortal wound while assisting Spain against France, and died a week later at Syracuse, Apr. 29, 1676. He was buried in Amsterdam.

DERVISH or **DARWESH**, a general name for a member of a Moslem religious fraternity, or, in Persia and Turkey (before their expulsion), a religious mendicant such as, in Arabic, is known as a *faqir*. (*See* FAKIR.) For many centuries individuals took up this form of religious life, but in the 12th century, orders began to form. The Qadarites seem to have been the first dervish order of all that still exist. Dervish theology came from Islamic mysticism known as Sufism, but some orders reject both the ritual and the moral law of Islam. Their practices stress emotion, and tend to produce hypnotic phenomena and ecstasy. The most important exercise is the *dhiqr*, or "remembering" Allah, whether accompanied by dancing, jumping, whirling, or howling.

DERWENTWATER, a lake in Cumberland, England. It is 3 mi. long and near the middle about 1 mi. wide. Considered one of the most beautiful lakes of the country, it has abrupt, rocky banks and contains several wooded islands. Masses of softland covered with green vegetation float through its waters and add to the general verdure and beauty of the scene. The lake is actually an expansion of the Derwent River. Its greatest depth is 70 ft.

DERZHAVIN, GAVRIL (1743-1816), Russian poet and dramatist, was born near Kazan, July 14, 1743. His father was an impoverished nobleman, bequeathing to his son a constant struggle with poverty. Derzhavin is considered the greatest Russian poet of the 19th century. Gogol calls him "the poet of greatness" because of his propensity to select sublimity in his themes. His odes and lyrics express a joyous Epicureanism and love of life, and his range is wide. His dramas are considered negligible. Derzhavin died at Orenburg, July 21, 1816.

DE SANCTIS, FRANCESCO (1817-83), Italian critic and historian of literature, was born at Morra Irpina, Avellino, in 1817. The formative period of his literary technique, during which he was engaged in the critical study and teaching of literature, lasted until 1850. This was followed by the destructive and negative period of the *Saggi Critici*, and by a constructive period exemplified by his critiques on PETRARCH and DANTE. His great work, *The Story of Italian Literature*, 1873, is distinguished by unusual analytical power, and De Sanctis has been called "the keenest critic of the 19th century." He died in 1883.

DESCARTES, RENE (1596-1650), French philosopher, was born at La Haye, Mar. 31, 1596. He was educated in a Jesuit school at La Flèche but left in 1612, not liking the type of instruction received. Most of his life was spent abroad. For several years Descartes was in the Dutch and German armies. Finally in 1629 he moved to Holland, where he found the quiet needed for producing his works. Among these his *Discourse on Method*, 1637, *Meditations*, 1641, and *Geometry*, 1637, are the most important. Shortly before his death Descartes was invited by Queen Christina of Sweden, one of his admirers, to the Swedish court. He died in Stockholm, Feb. 11, 1650.

Descartes was first and last a mathematician, and his mathematical method is reflected in his philosophy. He is generally regarded as the founder of



FROM M. M. OF ART

DERVISH OF ABOUT 1630-1640
Drawn in the style of Riza
Abbasi, Persian court painter

analytical geometry. With him the problems of modern philosophy become more articulate and from him develop various lines of thought. See *CARTESIANISM*.

DESCENT, among primitive peoples, is reckoned sometimes through the father, sometimes through the mother. It cannot be proved that either of these methods preceded the other, since they occur side by side in the same regions and in almost equal quantities. Descent through the father would give a family line like that of the present day, the children inheriting name and possessions from their father and considering themselves to belong to his family or *GENS*. When descent is reckoned through the mother, the children belong to her family and bear its name. Property, therefore, if it is to be kept in the family line, cannot descend from father to son. A man must leave his possessions to those of his own name, i.e., to his sisters' children. His own children will inherit, in the same way, from their mother's brothers. See also *CLAN*.

DESCHAMPS, EUSTACHE (c. 1340 - c. 1405), French poet, was born at Vertus, Champagne, about 1340. After studying at Orléans, he traveled in Europe, Asia and Africa, and was for a time, a slave among the Saracens. Returning to France, he held court appointments under several sovereigns, often, in war, fighting at their sides. He was favored for diplomatic missions. His principal work is a collection of 1,000 ballads, written in a most individual style, and full of piquant information about himself and the life of the time. Some are violently anti-English, and many vehemently complain against women, as does his *Miroir de Mariage*. Deschamps died about 1405.

DESCHANEL, PAUL EUGENE LOUIS (1856-1922), French statesman, was born at Brussels, Feb. 13, 1856, where his father, Emile Deschanel, a distinguished publicist, was living in exile. Having studied law, and served as secretary to two public men, young Deschanel was elected to the Chamber of Deputies in 1885, and later became successively Vice-President (1896) and President (1898-1902, 1912-1920) of that body. In 1905-09 he was head of the Commission on Foreign and Colonial Affairs, and in 1920, having filled several other important offices, he was elected President of France, holding that office from Feb. 18 to Sept. 21, 1920, when ill-health caused his resignation. He was the author of several literary works, and was elected to membership in the French Academy in 1899. He died in Paris, Apr. 28, 1922.

DESCRIPTIVE GEOMETRY. An ordinary drawing or a photograph of a three-dimensional object distorts more or less the different parts of the object. It is the purpose of descriptive geometry to provide methods for an adequate representation of objects in space as to their location and their exact shape. Furthermore, descriptive geometry provides means by which geometric constructions to be carried out in space are replaced by constructions executed in the plane.

This method of representing an object in space consists first in projecting it upon planes of reference, usually a horizontal plane *H*, a vertical plane *V*, and a profile plane *P*, these three planes ordinarily being taken perpendicularly to one another, as in solid

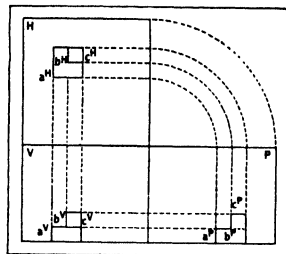


FIG. 1
PROJECTION OF OBJECT IN SPACE ON *H*,
V AND *P* PLANES

ANALYTIC GEOMETRY. (Fig. 1.) The common lines of intersection of these planes are called the ground lines. The horizontal and profile planes are then revolved about the respective ground lines until they coincide

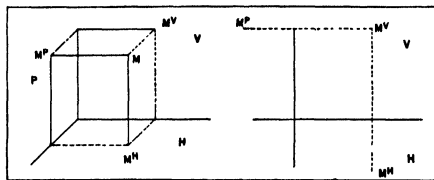


FIG. 2

with the vertical plane, the three projections of the object (see Figs. 2 and 3) thus being brought into the same plane. This affords an opportunity to carry out the constructions referred to above. For the elaboration

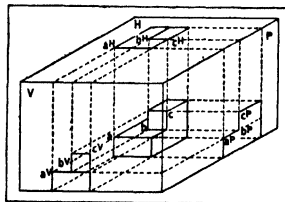


FIG. 3

tion of the rules to be followed in these constructions descriptive geometry draws freely upon the theoretical branches of GEOMETRY.

Descriptive geometry is a necessary part of the training of an engineer and is therefore included in the curriculum of technical schools. N. A-C.

BIBLIOGRAPHY.—Among the most popular textbooks on the subject in American schools are Jordan and Porter, *Descriptive Geometry*; G. J. Hood, *Geometry of Engineering Drawing*.

DESERET, STATE OF, 1849-50, the provisional government which preceded the organization of the Territory of Utah. A convention of "the inhabitants of that portion of Upper California lying east of the Sierra Nevada Mountains" met in Salt Lake City early in 1849, agreed upon the name Deseret ("land of the honeybee" in the Book of Mormon) for the future state, and adopted a constitution. On Mar. 12 Brigham Young was elected governor by popular ballot, and a legislature was chosen which met for the first time in July. Congress refused to admit Deseret as a state, and instead created the Territory of Utah, Sept. 9, 1850.

DESERT, a relatively rainless tract, supporting little or no vegetation. These stony or sandy wastes are habitable only upon their green Oases, where they are watered by springs or streams, or by artificial irrigation. True desert conditions prevail in parts of the Great Basin region of the southwestern United States, as in the Colorado desert of California, and the Mohave Desert of California and Arizona. The greatest desert of the world, the Sahara, with an area of at least 2,000,000 sq. mi., forms part of an arid belt which crosses north Africa, continuing through Arabia, Persia and Turkestan into Mongolia where it becomes the Gobi desert. South of the equator a more broken desert belt is traced in South Africa, South America and Central Australia. These belts mark the track of the drying trade winds, which are the most frequent cause of desert conditions.

The climate of deserts is characterized by these thirsty winds which have dropped their moisture over mountains interposed between the desert and the sea; by clear air, destitute of water-vapor; and by cloudless skies, making for devouring heat by day with rapid radiation after sundown. The daily range of temperature is very great. In the Sahara the thermometer may drop from about 125° at midday to freezing at night. Rainfall varies from less than 10 in. a year to an immeasurably small amount, rains descending in sudden cloudbursts which with devastating sandstorms and whirlwinds are features of desert weather. The heated air often produces the optical illusion called mirage. The scanty vegetation consists mainly of leafless, spiny plants like the cactus, adapted to the storing of water. The few species of desert animals, among them the camel and the ostrich, are hardy and fleet-footed.

When reclaimed by irrigation, as in the Imperial Valley, California, and in parts of the Sahara, desert soil shows remarkable fertility, producing abundant crops, especially of alfalfa, fruits and vegetables.

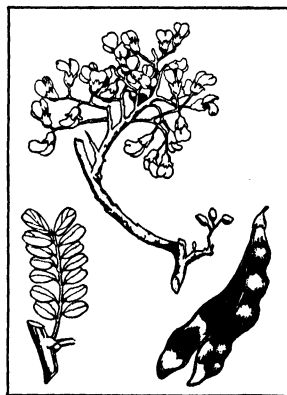
DESERTER, in a military and naval sense, a member of the armed forces of the country who without authority and with intent not to return absents himself from the service. The statutory articles for the government of the service arms of the United States provide also that "Any person subject to military law who quits his organization or place of duty with the intent to avoid hazardous duty or to shirk

important service shall be deemed a deserter." A similar rule prevails in the British Service.

BIBLIOGRAPHY.—*Manual for Courts Martial*, U.S. Army; *Manual of Military Law*, The War Office, London; Davis' *Military Law of the United States*.

DESERT HOLLY (*Atriplex hymenelytra*), a compactly branching plant of striking appearance, belonging to the goosefoot family and native to arid regions in the southwestern states. It grows from 1 to 3 ft. high from thickened and often very gnarled woody bases, bearing roundish leaves, which are covered with a thick silvery-white scurf and armed with coarse teeth.

DESERT IRONWOOD (*Olneya tesota*), a small tree of the pea family, native to desert valleys in southern California, Arizona and northern Mexico.



FROM JEPSON. MAN. FL. PLANTS CALIF.. COPYRIGHT

DESERT IRONWOOD

Flowering branchlet, leaf with stipular spines, and pod

It grows from 15 to 25 ft. high with thin scaly bark and a short trunk dividing into upright branches. The spiny branchlets bear pinnately divided leaves, small violet or purple flowers and light-brown seed pods. The very hard, heavy wood, which makes an excellent fuel, is sometimes manufactured into various small objects.

DESERT PLANTS, a large group of botanically unrelated plants that tolerate extreme aridity. While no plants grow in a true desert where rain never falls, an annual or semi-annual rainfall of 1 or 2 in. will maintain some sort of desert flora. As a result of deficiency of water, due usually to great heat, and brilliant sunshine, desert plants are under a severe handicap to survive. Many of them like the cactuses of America and the spurges of South Africa, have ephemeral or no leaves and large water-storage capacity in their fleshy stems.

Many desert plants are very prickly, the spines often replacing twigs, leaves or leaf-stalks, notably in some acacias, the ocotilla and many others. Where there are persistent leaves they are usually covered by an

ashy tomentum, or they may be highly varnished, or otherwise protected from excessive transpiration.

Unlike nearly all other plant communities desert plants are usually widely scattered, and there may be square rods or even acres of bare soil. Few trees or shrubs develop in such an environment, those that survive being stunted and often very thorny. *See* SAGUARO; PALO VERDE; CHOLLA; CREOSOTE BUSH; OCOTILLO; MESQUITE. N. T.

DESERT WILLOW (*Chilopsis linearis*), a shrub or small tree of the bignonia family, called also flowering willow. The tree is common along stream banks and near springs in arid regions in the southwestern states and adjacent Mexico, and is occasionally planted for its attractive bloom. It grows from 10 to 20 ft. high, with slender, upright branches and narrow, willow-like leaves. The handsome, somewhat trumpet-shaped, pink flowers blossom profusely from early summer until late autumn.

DESICCATION, the operation of drying or removing a liquid from a substance. A closed vessel, in which the material to be dried is placed with a hygroscopic substance is used for desiccating materials subject to injury by heat. These desiccators are frequently so equipped that they may be evacuated. More generally, desiccation is affected by currents of heated air or indirectly heated chambers. Non-aqueous liquids are dried by shaking them with a hygroscopic substance, e.g., calcium chloride. CELLULOSE compounds dissolved in glacial ACETIC ACID are desiccated by spraying them into a current of heated air. *See also* DEHYDRATION; DRYING AND DRYING EQUIPMENT.

DESIGN (Lat. *designare*, to mark), to form an idea, as a scheme; to contrive for a purpose; to outline a scheme. The English word, *design*, has come to be of supreme importance in art terminology. Its meaning has developed until it now embraces not only the scheme of layout, of COMPOSITION and of arrangement, but refers more largely and in particular to that part of art which gives its power, its effect of good taste, and its appeal to the emotions. It is the possession, or the lack of possession, of design that determines whether or not a creation is a work of art.

Design has to do with *relationships* that may be so ably and sensitively constructed as to create art. These are the relationships of the sizes of masses, their form (shape, contour), the relationships of these masses in the matter of light and dark, of brilliance or the lack of it, and also the relationships of colors. There are fundamental reasons, both mathematical and chemical, which account for the so-called rules of design.

Of these rules the more important are indicated by the terms *harmony*, *balance*, *rhythm* and *dominance*. Harmony is the just adaptation of parts to one another and to the whole. Balance is an equalization of weight. Rhythm is a measured repetition of accents, which is emphasized when the accents have a common tendency of direction. Dominance is the effect of superior importance. According to Batchelder, "harmony is a broader term than either rhythm or

balance; it may, in fact, involve one or the other, or both, of these terms. It consists in shunning differences too pronounced, contrasts too startling; in giving to the various elements of a design something in common. Uniformity of details, tone, measure and shape might be defined as perfect harmony. But uniformity is assuredly not the most pleasing manifestation of harmony. The eye craves contrast, variety; how far to go, where to stop, is the problem of the designer."

The subject called design as taught in schools of art is divided into constructive design and applied or decorative design. Constructive design has to do with the invention of objects of three dimensions, such as statuary and edifices. Applied or decorative design has to do with the creating of patterns for the enrichment of surfaces, and requires the inventions of suitable decorative *motifs* (motives, figures, units) and the selection of a *system of arrangement* which will govern and facilitate the use of these *motifs*. The beauty of contour of the *motifs*, of contour of the *voids* (background spaces), of color and of the effects of texture are important for the enrichment of surfaces. *All-over patterns*, also called *repeats*, are composed of 1. single units, or 2. groups of units, or 3. continuous growth. These are designs for unlimited areas, such as wall paper and textiles. Designs for limited areas, such as book covers, rugs, table-cloths, require the consideration of (a) the border, and (b) the inclosed area, which is the space surrounded by the border. Motifs are made up of abstract forms or of forms conventionalized from nature. In the creating of a *motif* from natural forms, as of plants, conventionalization consists in keeping the general characteristics of these forms, and omitting small details and accidents of growth, as the method of applying the design may require. It usually includes emphasis upon the geometric basis underlying natural forms. It is probable that conventionalization originated in the limitations imposed by the materials used. This is indicated in the simplification of forms carved upon stone by the early Egyptians and the Assyrians. Conventionalization is of two kinds, formal and informal. Broadly speaking, it is formal when purely decorative shapes and arrangements are developed without perspective appearance, even though natural form and growth be taken as a guide. It is informal when purely decorative shapes and arrangements are developed with perspective appearance. The simplest designs are often the most effective, and ornamentation can easily be overdone.

Decorative design involves forethought in the consideration of *fitness to purpose*. A design for a specific purpose requires the designer's careful taking into account of the use to which the thing is to be put. His design must not detract from the usefulness or the beauty of the object to which it is applied. To cite Batchelder again, the "Beauty of a surface pattern depends more upon the rhythm of the units over the surface than upon the form of the units themselves." Ruskin asserts that "design is not the off-

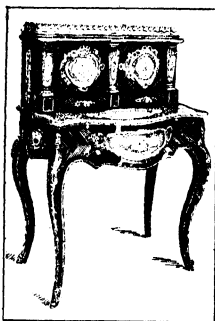
spring of idle fancy; it is the studied result of accumulative observation and delightful habit." And Allen writes that "the relationships that are design never come by chance." "I believe in Michelangelo, Velasquez and Rembrandt, in the might of design, the mystery of color, the redemption of all things by beauty everlasting, and the message of art that has made these hands blessed. Amen. Amen": thus G. B. Shaw.

J. C. C.

BIBLIOGRAPHY.—E. A. Batchelder, *Design in Theory and Practice*, 1910; J. C. Chase, *Decorative Design*, 1915; G. Warren and H. B. Cheney, *Romance of Design*, 1926.

DESIGN, THEATRICAL COSTUME. See THEATRICAL COSTUME DESIGN.

DESK, a piece of furniture for reading or writing, usually with a flat top. Its early form was a high and slanting oak slab on a pedestal, with no provision for the storage of writing materials and letters. The addition of drawers, and later of a supporting framework of legs and stretchers, marked the evolution of the desk. Two types of desk, the writing table and the bureau or *escritoire*, developed simultaneously. The table was widely used in France and was often decorated with inlay and carved metal mounts. Under Louis XVI a small knee-hole desk



COURTESY M. M. OF ART
19TH CENTURY FRENCH MARQUETRY DESK WITH SEVRES PORCELAIN PANELS AND ORNOLU

with a tambour frame was popular; it was composed of a series of narrow wooden shutters mounted on canvas, which rolled back. The cylinder-top desk was developed in France about 1750.

The bureau or *escritoire* had many forms and flourished particularly in England and America. Shelves covered with glazed doors were added above the desk, producing the secretary. Those of the famous English cabinet-makers of the 18th century were usually architectural in design, and were made chiefly of walnut and mahogany. The

interiors were variously arranged with small drawers and pigeonholes. THOMAS SHERATON designed the kidney-shaped writing table, a knee-hole desk with drawers in the pedestal ends. John Goddard of Connecticut was highly successful with desks of both the block front and the curved *bombé* types. The widely copied Governor Winthrop secretary was of slightly later design. The modern American roll-top desk is a derivation of the French cylinder-top and tambour desks. The usual office desk has a flat, horizontal top for writing upon and a number of drawers in which papers and supplies may be kept. A popular type accommodates a TYPEWRITER which may be dropped out of the way when not in use. There are many special types of desks suitable for particular uses.

DESMAN, an aquatic, fur-bearing animal, closely related to the moles. The Russian *desman* (*Desmana moschata*) is somewhat smaller than a muskrat, has webbed feet, a long, flexible snout, and a scaly tail,



COURTESY M. M. OF ART

AMERICAN TAMBOUR DESK OF THE 18TH CENTURY
Hepplewhite style mahogany

flattened laterally into an effective sculling-oar. The soft, otter-brown fur is musk-scented. The animal burrows in stream-banks, feeding on grubs, leeches, and small molluscs nosed out of the mud.

DESMAREST, NICHOLAS (1725-1815), French geologist, was born at Soullaines, France, Sept. 16, 1725. His early essay on the possibility of a former land connection between England and France won for him a substantial prize and he was then employed by the French government to promote the establishment of industries in that country. He continued his studies of natural science, however, devoting much time to the extinct volcanoes of the Auvergne, upon which GUETTARD had done preliminary work. His memoirs illustrate for the first time with concrete examples the method by which land was denudated by streams. The *Encyclopaedia of Diderot* and D'Alembert contains four volumes on physical geography written by him. He died at Paris, Sept. 20, 1815.

DESMIDS, a family of fresh-water, microscopic, one-celled algae, somewhat resembling the diatoms but without the siliceous shell. The organism is usually constricted, forming two similar halves; the semi-cells are connected by a bridge, called the isthmus. Reproduction is mostly asexual.

DES MOINES, the capital city of Iowa, the county seat of Polk Co., in the central part of the state. It is situated on both sides of the Des Moines River, at the mouth of the Raccoon, about 350 mi. west of Chicago and about 145 mi. east of Omaha. Railroads, airplanes, and bus and truck lines serve the city. The municipal planning scheme has given special attention to beautifying Des Moines. The notable buildings are

the Capitol, the State Library, the State Historical, Memorial and Art building. The new civic center along the river includes a city hall, court-house and a stadium seating over 8,000 people. Corn, cattle and hogs are leading products of the region; coal is mined in and about the city which is underlaid with this commodity.

Des Moines is the headquarters of about 50 insurance companies. Printing and publishing is an important industry. The principal manufactures are automobiles and automobile accessories, foundry and machine shop products, meat products, cosmetics, medicine, and clothing. The factory output for 1929 was valued at about \$98,000,000. The wholesale trade proper amounted to \$79,421,809, and the retail trade to \$92,956,713. Des Moines is the seat of Des Moines University (Baptist, 1865) and Drake University (Disciples, 1881). In the vicinity are Camp Dodge and Ft. Des Moines, established in 1843. Des Moines became an incorporated town in 1851, made the state capital and a chartered city six years later. Pop. 1920, 126,468; 1930, 142,559.

DES MOINES RIVER, the largest river in Iowa, rising in the southwestern part of Minnesota. This stream intersects Jackson Co., Minnesota, enters Iowa in Emmet Co. and flows generally southeast across the state to join the Mississippi directly below Keokuk. The drainage basin of the Des Moines is estimated at 14,652 sq. mi. The river valley forms one of the most productive farming regions in the United States and in the vicinity of the city of Des Moines there are extensive bituminous coal deposits. The length of the river from Windom, Minn., to its mouth is 411 mi. and its fall, which is about 853 ft., is greater along the lower part of its course where it furnishes abundant water power. In addition to Des Moines, Estherville, Fort Dodge and Ottumwa are located on its banks. It is fed by a number of tributaries including the East Fork and Boone on the east, and on the west the Raccoon which joins it at Des Moines. The river is navigable by steamboats to the mouth of the Raccoon.

DES MOINES UNIVERSITY, at Des Moines, Ia., a coeducational institution, founded in 1852. It is under Baptist control but is non-sectarian. There are 23,500 volumes in the library. In 1927-28 there was a student enrollment of 351 and a faculty of 38.

DESMOULINS, LUCIE SIMPLICE CAMILLE BENOIT (1760-94), French revolutionary, was born at Guise, Picardy, Mar. 2, 1760. He practiced as an advocate in Paris, but lacked the qualities for a brilliant career in that profession. After the fall of Necker he organized and led a revolutionary crowd and incited the storming of the Bastille. Influenced first by Mirabeau, then by Danton, he rose steadily as a leader until in 1791 he was the spokesman for those who demanded that the king be deposed. During the Terror his paper *Le Vieux Cordelier* labored against its excesses, and Robespierre ordered his execution in Paris on Apr. 5, 1794.

DE SOTO, FERDINAND (1496-1542), Spanish adventurer, was born in Villanueva de la Serena.

After going with Cordoba to Nicaragua in 1524, and serving with Pizarro in Peru in 1532, he went back to Spain to organize an expedition to search for the reputed wealth in Florida. He received assistance from King Charles V, was given the title of governor of Cuba and Florida, and started in 1538. After establishing his authority in Cuba he continued in 1539 to Florida. Although there were frequent conflicts with the Indians and no gold was found, he stayed in Florida for about three years. When his followers were contemplating deserting, De Soto decided to lead them to New Spain or Mexico; on the way he discovered the Mississippi River, but later contracted a fever and died in 1542.

DE SOTO, a city in Jefferson Co., eastern Missouri, situated 42 mi. southwest of St. Louis. Bus lines and the Missouri Pacific Railroad afford transportation. The region is rich in natural resources, yielding lead and barium. Dairying, stock raising and mining are the leading interests of the vicinity. Shoes and railway cars are the chief manufactures. De Soto was founded in 1802. Pop. 1920, 5,003; 1930, 5,069.

DESPENSER, HUGH LE (1262-1326), English courtier, was born in 1262. He commanded troops in Wales, France and Scotland during the reign of Edward I, and was sent on various diplomatic missions to the Continent. In 1312 he replaced Gaveston as the favorite of Edward II, and became head of the court party. He was banished in 1321, but was recalled and after crushing the rebellion at Boroughbridge, was in complete control of the country. His downfall was brought about by a rebellion led by Isabella, the queen, which resulted in Despenser's defeat at Bristol. He was hanged there on Oct. 27, 1326.

DESPIAU, CHARLES (1874-), French sculptor, was born in Mont de Marsan, France, in 1874. He studied at the Ecole des Arts Decoratifs, at the Ecole Nationale des Beaux Arts, and under Auguste Rodin. Despiou became especially successful as a maker of portraits, among them busts of Mme. Friez, Miss Aman-Jean, Mme. Faure, Leon Deshairs and M. Lievre. His other works include emblematic figures, pieces for gardens, and a war memorial for Mont de Marsan.

DES PLAINES, a city in northeastern Illinois in Cook Co., situated on the Des Plaines River, 16 mi. northwest of Chicago. Bus lines and the Chicago and Northwestern Railroad serve the city. The Pal-Waukee Airport is 5 mi. north. Garden products are the chief crops in this vicinity. The principal local manufacture is electrical supplies. Nearby is Cook County Forest Preserve. Des Plaines was founded by French explorers in 1834 and incorporated 1874. Pop. 1920, 3,451; 1930, 8,798.

DESPOT, an absolute ruler of many ancient Greek states, whose power in the earlier times was based on economic and political conditions, in the later, on military prestige. The despots ruled the people in disregard of the representative institutions of the time. The term is also applied to the Tarquins of ancient Rome.

DESSAU, a German city, capital of the free state, former duchy of Anhalt on the Mulde River, 2 mi. from its junction with the Elbe. The ducal palace has an eastern wing built 1530-49 and a western wing rebuilt in 1872-74 in Renaissance style. To the north of the castle lie the park, the orangerie and the theater, all built in the 18th century. The castle church, rebuilt in 1506-41, has pictures by Lucas Cranach and his school. The Amelia Foundation also has collections of German and Dutch paintings of the 18th century. It is the seat of an airplane works, several sugar refineries and railway-coach building works. Pop. 1925, 72,375.

DE STAËL, MADAME. See STAËL, MADAME DE.

DE STEFANI. See STEFANI, ALBERTO DE.

DESTROYERS, unarmored vessels generally of 1,000 to 1,700 tons' displacement. There are exceptions to as low as 600 tons' displacement—in the case of Italy and France—and to as high as 2,400 tons', built by the latter. This type of vessel is fitted with guns of medium caliber, varying in general, from 4 in. to 7 in. Destroyers have a speed of 28 to 39 knots per hour; many carry antiaircraft guns.

When destroyers came into constant use, about 1892, the torpedo boat was gradually discarded. Destroyers were used against the menace of submarines, and in time, became an auxiliary of the battle fleet. They were employed to protect battleships, guarding against torpedo attacks, protect airplane carriers and to attack submarines by ramming or bombing them. In the World War it was necessary to use a certain number of these vessels in convoy duty.

Special destroyers are used in mine laying and large ones of increased fighting power serve as flotilla leaders. These leaders are of similar build, but have greater displacement and, consequently, greater steadiness of platform than the regular type. Destroyers of the three leading powers are limited under the terms of the London Treaty. The age limit for replacements is 16 years. A number of the older destroyers of the United States are in service in the COAST GUARD. R. E. C.

DESTROYER TENDERS, seagoing vessels that accompany DESTROYER squadrons of various fleets. They are especially equipped for the purpose of making necessary repairs or changes beyond the capacity of the destroyers themselves. They carry supplies of spare parts, food and the like and are limited as to size and armament by treaty.

DESTRUCTIVE DISTILLATION. See CARBONIZATION; WOOD DISTILLATION.

DESTRUCTORS. See REFUSE DISPOSAL.

DESUPERHEATER, an auxiliary BOILER apparatus used to convert superheated steam to saturated steam. A well-known type comprises an egg-shaped steel shell with interior baffle plates, a water spray, water-level control mechanism and water-circulating pump. SUPERHEATED STEAM enters on one side, passes around the baffle plates and comes in contact with the spray of water which cools it. It then passes into the outlet as SATURATED STEAM. Desuperheaters are

widely used in marine power installations to desuperheat the steam used in auxiliaries, as in reciprocating feed pumps.

DETAILLE, JEAN BAPTISTE EDOUARD (1848-1912), French military painter, was born at Paris, Oct. 5, 1848. He studied with Meissonier, acquired a strong taste for military painting and during the War of 1870 made a reputation by his scenes of soldier life, in which details were carefully and truthfully depicted. He later recorded his impressions of an expedition to Tunis and a visit to Russia. Detaille died at Paris, Dec. 23, 1912.

DETECTIVE, one whose business it is to discover concealed matters, chiefly criminal. A successful detective must be able to work without attracting attention and be sufficiently adaptable to fit into any society or assume any character which serves the gathering of needed information. He must be fearless and adventurous and at all times keenly observing. He must be trained in the modern science of his profession, such as relates to finger-print identification, and he must have a knowledge of criminal weapons, resources and tactics. An understanding of criminals and criminal psychology, a memory for facts and faces and the knack of securing convicting evidence through cross-examination are also essential requirements. In large cities, detectives are members of the police force, officially engaged in public protection or of detective agencies, engaged unofficially to obtain information or to guard the private interests of individuals or firms.

DETECTOR, a radio device for detecting variations of amplitude in a train of wireless waves (see HERTZIAN WAVES). The basic principle of operation is that of rectifying the high-frequency currents impressed on the ANTENNA.

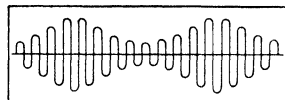


FIG. 1. HIGH-FREQUENCY CURRENT BEFORE RECTIFICATION

Even if the high frequencies involved in RADIO COMMUNICATION could be converted into SOUND waves, they would be inaudible, and, in any case, they would



FIG. 2. MODULATED HIGH-FREQUENCY CURRENT AFTER RECTIFICATION BY DETECTOR
The dotted line represents the average value

carry no intelligence. However, consider the graphical representation of the high-frequency current in a radio circuit as shown in Fig. 1. If the alternating potentials associated with these currents are applied to a circuit containing a RECTIFIER, there will be pulses of current in one direction as shown by Fig. 2. The

average value of these pulses is shown by the dotted line. This current is available for use in a pair of head-phones or for the input circuit of an AMPLIFIER.

Perhaps the simplest method of efficient detection is by means of the rectifying action of a simple CRYSTAL DETECTOR. The process is more complicated when a three or four-element electronic tube is used (see TUBES, ELECTRONIC). In this case, the average value of current in the plate circuit varies with the MODULATION of the radio signal. See also RADIO RECEIVER.

L. G. H.

DETENTION HOMES. Most of the juvenile court laws of the United States provide for the establishment of detention homes for the temporary care of dependent, neglected or delinquent children pending disposal of their cases by properly organized courts. In some cases—increasingly few—the detention home is a part of a jail or of the court building itself. In other cases, small institutional buildings are provided with matron, superintendent or other officers, while in still others, private homes under proper supervision receive the children until their cases are decided. The use of such separate homes, which provide an atmosphere divorced from the institutional, has continually been gaining acceptance. A comprehensive study of the Wayne County Detention Home, Detroit, Mich., indicates that there are many unnecessary cases brought before the juvenile court and occasional long delays. The experience of social workers shows that few children require the isolated care of institutional detention homes, and that foster care gives the best results. In 1929, a survey of 500 unselected cases proved that 70% were helped by foster home care; among the mentally or emotionally abnormal, 45% were improved, and of normal children, 90%.

Communities which furnish foster home care, with proper supervision to maintain standards, include Boston, Wilkes-Barre, Harrisburg, Minneapolis, St. Louis and Los Angeles. The Federal Child Bureau announced in 1927 that 19 of 44 cities, population from 25,000 to 100,000, then used private homes for temporary detention care. A nationwide study of detention of children was started during 1929, under the auspices of the National Probation Association, on a grant of \$33,000 from the Bureau of Social Hygiene. This survey completed in 1932 studied existing systems and made constructive recommendations. For adult detention homes—a phrase not now widely used—see REFORMATORIES: JUVENILE DELINQUENCY; CHILDREN'S COURTS.

DETERMINANT, an element of a word inserted between the BASE and the INFLECTION, although, unlike them, its presence is not essential to a complete word. It "determines" or modifies the meaning of the base, but in many cases its precise original meaning is now lost. All formative elements may be considered determinants, as Indo-European base **terei-*, "tremble" (Sanskrit *tara-íd*, "quivering"), **tre-sei-* (Sanskrit *trása-ti*), **tre-mei-* (Latin *trem-it*), **tre-pe-* (Latin *trep-idus*), or, from Latin *amo*, "love," *ama-*

tui-o, "wish to love," *ami-c-o*, "make friendly," *amabili-s*, "lovable," *ama-nt-is*, "of a lover," *ama-siu-s* "lover," *ama-si-unc-ulu-s*, "dear little lover," *ama-tor*, "lover," *am-or-is*, "of love," *am-or-a-bundu-s*, "loving," etc.

BIBLIOGRAPHY.—P. Persson, *Studien zur Lehre von der Wurzelweiterung und Wurzelvariation*, 1891.

DETERMINANTS, in algebraic mathematics. If a pair of simultaneous equations (1) $a_{11}x + a_{12}y = c_1$ and $a_{21}x + a_{22}y = c_2$ be solved for x and y it is found that (2)

$$x = \frac{c_1 a_{22} - c_2 a_{12}}{a_{11} a_{22} - a_{12} a_{21}}, y = \frac{c_2 a_{11} - c_1 a_{21}}{a_{11} a_{22} - a_{12} a_{21}}.$$

The polynomial (3) $a_{11} a_{22} - a_{12} a_{21}$, appearing in the denominator of these two fractions, is called the *determinant* of the coefficients of x and y in the equation (1) and is represented by the symbol (4) $\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}$.

The four numbers a_{11} , a_{12} , a_{21} , a_{22} , are called the elements of the determinant. The horizontal ranks of the elements are called the rows and the vertical ranks the columns of the determinant. Since the determinant has two rows and two columns it is said to be of the second order. In determinant notation, equation (2) may be written

$$(5) \quad x = \frac{\begin{vmatrix} c_1 & a_{12} \\ c_2 & a_{22} \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}}, y = \frac{\begin{vmatrix} a_{11} & c_1 \\ a_{21} & c_2 \end{vmatrix}}{\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}}.$$

In the polynomial (3) the two terms $a_{11} a_{22}$ and $-a_{12} a_{21}$ have been written with the first subscripts in numerical order so that the order of the second subscripts is fixed. In the term $-a_{12} a_{21}$ the second subscripts are not in numerical order, 2 coming before 1. Such a situation is called an inversion; and in general, in a row of numbers such as 2431 any occurrence of a number preceding a smaller one is called an inversion. There are four inversions in this example.

By means of the idea of inversions determinants of any order may be defined. From the array

$$(6) \quad \begin{vmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{vmatrix}$$

write down all possible products which can be formed by taking as factors one and only one element from each row and each column. Arrange the factors in such a way that the first subscripts are in numerical order. Then affix to each product a plus sign if the number of inversions in the second subscripts is even, or zero, and a minus sign if the number is odd. The algebraic sum of the resulting set of products is called the determinant of the above elements and is represented by the symbol (6) above. Applied to a third order determinant

$$\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$$

this definition gives

$$a_{11} a_{22} a_{33} - a_{11} a_{23} a_{32} + a_{12} a_{23} a_{31} - a_{12} a_{21} a_{33} + a_{13} a_{21} a_{32} - a_{13} a_{22} a_{31}.$$

Determinants play a very important rôle in many parts of mathematics, such as geometry, invariants and integral equations.

Matrices. A set of mn quantities arranged in a rectangular array of m rows and n columns is called a *matrix*. For example

$$\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \end{vmatrix}$$

is a matrix of two rows and three columns. The order of the elements in a matrix is essential. Two matrices are said to be equal if and only if each element of one is equal to the corresponding element of the other.

G. E. R.

BIBLIOGRAPHY—Most texts on college algebra give an elementary treatment of determinants. For a more advanced treatment, see Turnbull, *Theory of Determinants, Matrices, and Invariants*, Muir, *Theory of Determinants*, 4 vols.

DETERMINISM, in ethics, the theory which holds that the will is conditioned by the circumstances which precede its acts, and that voluntary action is therefore an illusion. Determinism is the opposite of free will. The controversy between free will and determinism is an old one, at present not so much settled as outgrown.

There are various degrees of determinism, relative to the extent to which the will is regarded as being determined. Thus there are the so-called hard and soft determinists, the former holding to rigid determinism while the latter, although admitting that the will is determined, at the same time preserve an element of freedom. In its extreme form determinism is exemplified by the theological doctrine of PREDESTINATION.

It is comparatively easy to argue away one's freedom. Nevertheless in acts of choice it is a common experience to feel that one could have acted differently. Were it not for this feeling there would be no meaning to the phenomena of regret and remorse. The determinist would argue that the individual only supposed he was free to choose in the case, whereas, as a matter of fact, given the situation as it was, he had to do as he did. His habits and environment and all the factors operating in the situation made only one line of conduct possible to him, if he but knew it. If all the factors involved were known, it would be found that there was no volition in the matter, that action had been previously conditioned. Determinism applies the principle of causation to moral action.

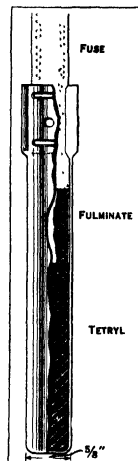
DETONATORS, small metallic capsules containing an explosive which will ignite readily and progress from combustion to maximum violence of detonation quickly. Their purpose is that of an intermediary

between a source of ignition and a main charge of high explosive. Their action consists in applying intense shock and heat effects which serve to initiate detonation waves in high explosives, which would otherwise burn or explode weakly. Usual charges are fulminate of mercury (*see* MERCURY, FULMINE OF) or lead azide (*see* AZIDES). Part

may be replaced by powerful secondary explosives as tetryl, T.N.T., and pentaerythritetetranitrate. The usual charge is one gram (0.35 ounce) or less; never more than two grams. Other methods of igniting the main charge are: blasting caps ignited by safety fuse and electric blasting caps ignited by an electrically heated bridge wire fastened between two conducting wires and embedded in a flash composition.

R. L. H.

BIBLIOGRAPHY.—A. Marshall, *Explosives*, 1917.



COURTESY U. S. WAR DEPT.

growth to its location on the line of water communication—River St. Clair-Lake St. Clair-Detroit River—between Lake Erie and Lake Huron. The waterway is also the dividing line between the United States and Canada. In 1931 the area of Detroit was 87,255 acres. The population in 1930 was 1,568,662; in 1920, 993,678, an increase of 57.9% in ten years. Detroit also is the county seat of Wayne Co. In January the average temperature at Detroit is 24° F., in July 72° F. The average annual precipitation is 32 in.

Geographic Setting. Detroit is located on relatively flat land which attains a maximum elevation of 661 ft. above sea level. It extends in a generally northeast-southwest direction, with a river frontage of 20 mi., and a maximum depth of 9 mi. On the southwest the city fronts for 4 mi. on the navigable River Rouge which empties into the Detroit River 4 mi. below the center of the city. The Detroit River flows west and ranges in width from 1/2 to 3 mi., providing an excellent harbor. On the opposite bank Detroit is faced by three Canadian municipalities, Windsor in the middle, Walkerville on the northeast, and Sandwich on the southwest, all belonging to Ontario Province.

Streets and Buildings. In 1931 Detroit, laid out on a rectangular street plan, had more than 1,780 mi. of paved streets. Woodward Avenue, 120 ft. wide, runs at right angles to the river, dividing the city into halves. One-half mi. from the river it expands

into the Campus Martius, a plaza measuring 600 by 200 ft., from which Michigan and Fort avenues radiate on the west at different angles. To the east of Woodward Avenue Gratiot Avenue corresponds in angle to Michigan Avenue. Four blocks beyond the Campus Martius, Woodward Avenue, the chief business artery, bisects the Grand Circus, another plaza which is the approximate center of downtown Detroit. Retail establishments line the streets radiating from the Campus Martius and the Grand Circus. One block west of and parallel to Woodward Avenue is Griswold Street, called the "Wall Street of Detroit," extending from the river to beyond the Campus Martius. Roughly parallel to the river are Fort Street, running west from the Campus Martius toward Fort Wayne, and on the east Monroe and Jefferson avenues. The northeastern section of Detroit is called Grosse Point, cut diagonally through Gratiot Avenue. Describing an arc from northeast around to the mouth of the River Rouge on the southwest are Hamtramck; Highland Park, cut by Woodward Avenue; Greenfield, cut by Grand Avenue; and Springwells, cut by Michigan Avenue. The heart of Detroit is circumscribed by Grand Boulevard, a superb parkway 150 ft. wide and 12 mi. long, which begins at Belle Isle Bridge, east of Woodward, and ends at 26th Street and the river, on the other side of the city.

Detroit's first building is the City Hall, a 3-story sandstone structure of the mansard type erected in 1871, which faces the Campus Martius. In the neighborhood is the Wayne County Courthouse on Cadillac Square; the Majestic Building; the Penobscot Building, 557.2 ft.; the Union Trust Co. Building, 482 ft.; the Book Tower, 459 ft.; and the Dime Bank Building, 284 ft. An entire block, bounded by Fort, Lafayette, Shelby, and Wayne streets, is occupied by the United States Government Building, which houses the Post-Office, Federal Courts and customs offices. The new building for the Art Institute, in Italian Renaissance style, was completed in 1927 in the Art Center, consisting of two blocks along Woodward Avenue. Other noteworthy buildings are the Public Library, on Woodward Avenue opposite the Art Institute, an example of early Renaissance architecture designed by Cass Gilbert; the General Motors Building, one of the largest office structures in the world; the Ford Building; Detroit *Free Press* Building; the Masonic Temple; the Book-Cadillac Hotel; the Fisher Building; and the Eaton Tower.

Parks and Monuments. Detroit is a rich city, and much of its wealth has been expended on parks, which in 1931 numbered 46 and had a combined total area of 3,193 acres. Chief among these is Belle Isle Park, beautifully located in the Detroit River, and connected to the American mainland by ferries and by a bridge constructed in 1923. Belle Isle, 2,193 ft. long and 810 acres in extent, is heavily wooded and provides space for a zoo, aquarium, a 9-hole golf course, canals for boating, tennis courts and playgrounds. Palmer Park, flanking Woodward Avenue, begins 6½ mi. from the river and provides 287 acres

of recreation grounds. Rouge Park, found in the west side of Detroit, covers, 1,203 acres. The important monuments are the Michigan Soldiers' and Sailors' Monument, a bronze and granite structure facing City Hall, and statues to persons celebrated in the French, Colonial and American history of Detroit.

Transportation. Detroit has excellent transportation facilities, due in part to its position between the Upper and Lower Lakes. Railroad transit is afforded chiefly by the Michigan Central, Pere Marquette, Wabash, Pennsylvania, New York Central, Detroit, Toledo and Ironton, Detroit and Toledo Shore Line, Grand Trunk, Canadian National and Canadian Pacific railroads. The river front provides dock terminals for shipping from Buffalo, Cleveland, Toledo, Mackinac, Chicago and other Great Lakes ports. There is regular airplane service from Detroit to Cincinnati, Buffalo, Chicago, Cleveland, Toledo and St. Louis. An airplane express service is maintained with its terminal at the Municipal Airport. There are bus and motor truck services. In addition to the water, rail and airplane carriers, transportation is provided within the city by city buses and by the municipal street-railway system, covering more than 425 mi. of streets.

Commerce and Industry. In 1930 the total cargo traffic on the Detroit River amounted to 72,897,752 tons, carried in 15,161 vessels. The industrial growth of the city was greatly accelerated by the great expansion in automobile manufacturing. In the first years of automobile manufacturing the most successful of the automobile factories happened to be in Detroit. This gave the city an early start, and it has never lost its lead in the industry. Experienced labor also favored the establishment of new factories in Detroit. In 1895 Ransom E. Olds began experiments at Detroit with the "horseless carriage," and on June 16, 1903, Henry Ford established his first factory in the city. The Ford Highland Park plant occupies about 300 acres and the River Rouge plant about 1,200 acres. When operating at capacity these two plants employ 100,000 men. Including the automotive groups of General Motors Corp., there are about 80 automobile plants in the Detroit area. The total plants in Wayne Co. number approximately 2,600. The ten most important manufactures, besides automobiles and automobile parts, are iron and steel, electrical machinery, apparatus and supplies, foundry and machine shop products, drugs, chemicals and allied products, paints and varnishes, stoves, paper and printing products, cigars and cigarettes, and machinery. For the year 1929 the value of Detroit's manufactures reached \$2,026,937,319. In the same year the retail sales in the city were valued at \$882,086,767. In 1930 the wholesale sales of Detroit and the remainder of Wayne Co., all establishments, were valued at \$1,578,055,671.

History. The first settlement on the site of Detroit was made by Antoine de la Mothe Cadillac, who built Ft. Pontchartrain in 1701. The English captured the fort during the French and Indian War. During the War of Independence the site was

a British stronghold, and it was held by the English until 1796, when it became American territory by the terms of the Jay Treaty. The British reoccupied the site during the War of 1812. In 1824 the community was incorporated as a city. Between 1837-47, Detroit was the capital of Michigan. In 1890 the population was 205,876, and the value of manufactures was \$77,351,546. With the impetus given it by the automobile industry, Detroit doubled its population between 1910-20 and quadrupled the value of its manufactures.

BIBLIOGRAPHY.—George B. Catlin, *The Story of Detroit*, 1923; W. P. Lovett, *The City That Rules Itself*, 1930.

DETROIT, SURRENDER OF, Aug. 16, 1812, an event of the WAR OF 1812. Gen. Hull, commanding American operations in the West, in July besieged Malden, on the Canadian shore opposite Detroit, important as the traditional meeting-place of British and Indians. The place doubtless could have been taken by assault; but Hull dallied, while the British army under Gen. Brock daily grew stronger. Hull became timorous and withdrew to the fortifications of Detroit, Aug. 8. Brock followed, and, playing upon Hull's fears that the Indian allies of the British would massacre all prisoners, demanded surrender. Although Brock's force was only 1,500, including 800 Indians, and Hull's 1,000 effectives had the advantage of the fortifications, Hull capitulated. About 2,000 men became prisoners of war, and 2,500 stand of arms, with a great quantity of military stores, were given up. Hull was subsequently court-martialed, and sentenced, Mar. 26, 1814, to be shot; President Madison approved the finding but remitted the punishment.

DETROIT RIVER, or St. Clair Strait, a river or strait of North America, which flows from Lake St. Clair to Lake Erie. It is 28 mi. long and of sufficient depth for the navigation of large vessels. Opposite the city of Detroit it is about three-quarters of a mile in width and enlarges as it descends. An immense lake trade passes through it, and a busy ferry traffic between Detroit and Windsor, Ont. In 1929 the Ambassador Bridge was completed. It spans the river between Detroit and Sandwich, Ontario.

DEUCALION and PYRRHA. In Greek mythology, Deucalion was the son of PROMETHEUS, King of Phthia, and Pyrrha was his wife. When ZEUS sent a flood to destroy the earth, these two were saved in a boat which floated for nine days and came to rest on Parnassus. The couple were told by the oracle to throw stones behind them. Those thrown by Deucalion turned into men and those thrown by his wife into women. Through their son Hellen they became ancestors of the Greeks.

DEUTERONOMY, BOOK OF, derives its title from the Greek translation of the Hebrew words in the 18th verse of the 17th chapter, "copy of this law," and is meant to convey the meaning that the book is supplementary or recapitulated legislation. An analysis discloses that it is rather, as its title implies, a second edition of laws, given, it is said, by Moses

during his last days in Moab, before the Hebrews entered their "promised land." The book consists of at least three distinct discourses, with poems and a few narratives of the last days of Moses. Since the early Christian fathers, doubts of the assumed Mosaic authorship have been expressed. The description of the death of Moses naturally led to such doubts. To-day many modern scholars tend to admit that it, or part of it, is the book discovered in the Temple, 622 B.C., as described in II KINGS 22, f., which occasioned Josiah's religious revival. It breathes a fine monotheism and emphasizes love in the relation between God and his people. In numerous passages and poetical sections it rises to an elevated religious feeling, and its ethics ring true to the spirit of the greatest Hebrew prophets.

DEUTSCHLAND ÜBER ALLES, "Germany Over All," the German national anthem written in 1841 by the German poet and historian, A. H. Hoffman. It is commonly sung to the tune of Haydn's *Austrian Hymn to the Emperor*, 1797.

DEUTZIA, a genus of small shrubs of the SAXIFRAGE family, several of which, together with numerous varietal forms and hybrids, are commonly cultivated as ornamentals. There are about 50 species, natives of eastern Asia and the Himalayan region. They are usually bushy with numerous spreading or ascending branches bearing opposite leaves and a profusion of white, bluish or purplish flowers, often double, in loose, more or less compound clusters.

DEVA or DEONA, the Roman name for the city of Chester, England, on the river Dee. It was founded by Roman legionaries A.D. 48 and called also Castra Devana, becoming a fortified town of importance. Portions of the old town wall are extant.

DE VALERA, EAMON (1882-), President of Irish Free State, was born in New York, N.Y., Oct. 14, 1882. As the only leader to survive the 1916 Rebellion he became the champion of the Sinn Féin despite his previously unimportant rôle in the Nationalist movement. When he won the East Clare by-election in 1917 with the aid of Prof. Eoin MacNeill, thus sealing the breach between the extremists and moderates in the Sinn Féin party, he became the principal leader. He was chosen President of the Irish Republic and since 1917 has headed the Republican Party. He opposed the treaty establishing the Irish Free State because of the oath of allegiance to the British Crown and engaged in a brief civil war, after which he refused to take his seat in the Chamber of Deputies until 1927. He then became leader of the constitutional opposition. De Valera was elected President of the Irish Free State again in 1932. See also IRELAND, HISTORY OF.

DEVENTER, a city of medieval appearance located in the Dutch province of Overijssel at the confluence of the Schipbeek and the Yssel. Deventer has a Gothic church with a crypt, the latter of the 11th century, a fine city hall with paintings by Terborch, foundries, carpet factories, cotton mills, tobacco factories, a brewery, and renowned honey-cake baker-

ies. It became a city in the 13th century and a member of the HANSEATIC LEAGUE in the 14th. It was under the supremacy of the bishops of Utrecht until their rights were transferred to Emperor Charles V in 1528. Under Philip II a bishopric was founded in 1559, but was suppressed in 1591, when Maurice of Nassau took the city from the Spaniards, into whose hands it fell in 1587, owing to the treachery of the English commander, Stanley. After that it was united with the free provinces of the Netherlands. In 1672-74 it was occupied by the bishop of Münster, Bernhard von Galen, and in 1813-14 by the French. Pop. 1930, 36,393.

DE VERE, AUBREY (1814-92), Irish poet, was born at Curragh Chase, Jan. 10, 1814, and was educated at Trinity College, Dublin. When 28 he published *The Waldenses*, and the following year his *Search after Proserpine* brought him wide recognition. He enriched the store of English devotional poetry, and helped bring back to Irish literature its wealth of myth and legend. Among his publications are *Poems Miscellaneous and Sacred* and *St. Peter's Chains*. A volume of selections from De Vere's poetry was published in 1894. He died at Curragh Chase, Jan. 21, 1892.

DEVIL, a spirit of evil, different from man but included in the universe where man has his home. According to Judaeo-Christian tradition, devils are angels who once were good but rebelled against God. Such was **LUCIFER**, fallen from heaven to hell, and **BEELZEBUB**, Prince of the devils, described by Milton in *Paradise Lost*. In the Old Testament the Devil was symbolized as a serpent or dragon, introducing sin into the Garden of Eden, when man was innocent. In the New Testament, Jesus was tempted by the arch-devil Satan and cast out devils from persons possessed of them. In Africa devil worship has been a religion, and devil dancing is a ceremonial. The Chinese have practiced grotesque rites whereby devils may be frightened away or eluded. Modern thought has attempted to modify these conceptions. To the alienist, possession by devils is held to have been a derangement of the mind, to be subjected to scientific study and amelioration. The anthropologist traces a belief in devils to primeval animism. On the other hand, the older view receives a certain support from those who, in every age, say with Shakespeare:

*There are more things in heaven and earth, Horatio,
Than are dreamt of in your philosophy.*

DEVIL FISH, usually a popular name for the octopus. It has a sac-shaped body from which two large, staring eyes seem to gaze with cold malignity on the world, eight snaky arms bearing two rows of disc-shaped suckers, and a parrot-like beak, placed in the region surrounded by the arms. Altogether its appearance is terrifying.

The devil fish is capable of rapid color change. Usually its colors tend to blend with its surroundings, but when the animal is angry or excited its color

seems to give expression to its emotion, without regard to safety. It can also conceal itself by ejecting a cloud of "ink."

The devil fish hides in crevices among rocks or corals to protect its soft body, and stretches forth its arms to seize passing fish or crabs. At least one species, the common octopus (*Octopus vulgaris*), has the power of paralyzing its prey with poison from its salivary glands.

Many devil fish are very small, with bodies no larger than a pear, but the common octopus, found in large numbers in the Mediterranean and about the West Indies, sometimes measures six feet in diameter from tip to tip of its outstretched arms, while the enormous octopus (*Octopus punctatus*) of the Pacific may have a reach of 28 feet.

Numerous tales have been told of devil fish attacking man. Often such stories are fantastic, like those which relate of their assaults on small boats, which they were supposed to upset and drag to the bottom, or like those which tell of their battles with man on beaches, out of water. However some reports of their attacks on pearl divers seem to be well substantiated.

A number of other sinister looking sea dwellers are sometimes called devil fish, the most important being the giant ray, *Manta birostris*, and the angler, *Lophius piscatorius*. See also ANGLER; OCTOPUS; RAY.

DEVIL POSTPILE, a national monument or reservation set aside July 6, 1911 and administered by the Department of Agriculture, is situated in the southeast corner of Madera Co., west central California. The monument is 800 acres in area and is characterized by huge hexagonal columns of volcanic rock which resemble an enormous pile of posts. These peculiar columns lie at every conceivable angle from vertical to almost horizontal. This Devil Postpile is of similar formation and is said to rival the famous Giant's Causeway in Ireland. The monument is just off a U.S. Interstate Highway and is but a few miles south of Yosemite National Park.

DEVIL'S-BIT (*Chamaelirium luteum*), a smooth perennial of the lily family called also blazing star and unicorn root. It grows in thickets and moist meadows from Massachusetts to Michigan and southward to Florida and Arkansas. The erect, somewhat fleshy stem, which rises from a bitter, tuberous rootstock, bears long-stalked, spatulate basal leaves, lance-shaped or linear stem leaves, numerous small white flowers in long, narrow, spikelike clusters, the male and female on separate plants, and three-lobed fruit-pods (capsules) containing many winged seeds. The dried rootstock, collected in autumn, is sparingly used for its medicinal properties.

DEVIL'S-CLAW, a name given to the **UNICORN PLANT**, a rough-hairy annual of the *martynia* family which bears fruit-pods terminating in slender, curving claws several inches long.

DEVIL'S-CLUB (*Echinopanax horridum*), an intensely prickly shrub of the ginseng family found in rocky places from northern Michigan to Oregon and

Alaska and also in Japan. The erect stem, sometimes 12 ft. or more tall, bears very large, orbicular, many lobed leaves, occasionally 2 ft. broad, with prickles on both sides, and numerous greenish-white flowers in small umbels forming a narrow compound cluster at the end of the stem. When growing in close thickets the devil's-club forms a serious impediment to travel.

DEVIL'S ISLAND, or Isle du Diable, the seaward island of the Safety group, lying off the coast of French Guiana. The island has an area of 16 sq. mi. and is one of the French penal settlements for confirmed criminals and political prisoners. It is chiefly celebrated as the place of the imprisonment during 1895-99 of Capt. ALFRED DREYFUS.

DEVIL'S LAKE, a city in northeastern North Dakota, the county seat of Ramsey Co., situated on Devil's Lake, 85 mi. northwest of Grand Forks. It is served by two railroads. There is an airport. The city is the trading center for a rich agricultural region producing chiefly wheat. Dairying is another important interest. In addition to public and parochial schools there is a State School for the Deaf. Pop. 1920, 5,004; 1930, 5,451.

DEVIL'S LAKE, the largest lake in North Dakota, situated between Ramsey and Benson counties in the northeastern part of the state. The lake has an exceedingly irregular shoreline and is approximately 50 mi. long.

DEVIL'S LAKE PARK, a state park located in Sauk Co., south central Wisconsin, established in 1912 with an area of 1,400 acres. The lake was formed by glacial drift which dammed both ends of a gorge. The great crags and bluffs surrounding the lake contain considerable Baraboo quartzite. There are extensive trails through rugged and well forested country.

DEVIL'S-PAINTBRUSH, a name given to the common orange HAWKWEED of the eastern United States, a rough-hairy perennial herb of the composite family with showy orange or red flower-heads.

DEVIL'S TOWER, a remarkable mass of volcanic rock situated in the Black Hills of northeastern Wyoming. The tower is 1,700 ft. in diameter at its base and rises 1,200 ft. above the Belle Fourche River. Its sides are fluted by great columns giving the tower the appearance of a bundle of huge matches held firmly together in a perpendicular position. Near the top the columns round in; at the base they flare out; the whole tower rests on a platform of buff sandstone. The tower, which can be seen in some directions for almost 100 mi., was a valuable landmark among the Indians who said that during thunderstorms the Thunder God beat his drum on its summit. It also guided the early white pioneers of the Northwest. An area of 1,152.91 acres including the tower was proclaimed a national monument, Sept. 24, 1906. Devil's Tower is reached by a side trip of 7 mi. from the Custer Battlefield Highway and the Black and Yellow Trail. The nearest railroad point is Moorcroft on the Chicago, Burlington and Quincy, 35 mi. distant.

DEVINE, EDWARD THOMAS (1867-), American sociologist, was born at Union, Ia., May 6, 1867. In 1896 he became secretary of the New York Charity Organization Society and in 1897 editor of the *Survey*. He was professor of social economy at Columbia University in 1905-19, and director of the New York School of Philanthropy in 1904-07 and 1912-17. In 1917-18 he was chief of the Bureau of Refugees and Relief of the American Red Cross in France. He undertook relief work after the disasters at San Francisco, Calif., in 1906, and at Dayton, Ohio, in 1913. He was a member of the United States Coal Commission in 1922-23, professor of social economy and dean of the Graduate School of the American University, Washington, in 1926-28, and in 1929 became director of the Bellevue-Yorkville Health Demonstration, New York City. He was active in tuberculosis relief work, prison reform and the study of industrial relations.

DE VINNE, THEODORE LOW (1828-1914), American printer, was born at Stamford, Conn., Dec. 25, 1828. He early learned the printer's trade. De Vinne was first employed by and later became the partner of Francis Hart, a well-known printer. On Hart's death the firm became the De Vinne Press, one of the most famous plants of its day. De Vinne was a leader in the improvement of typography and wrote a number of books on his subject, among them *Notable Printers of Italy During the 15th Century*. He was also a founder of the Grolier Club. His death came Feb. 16, 1914.

DEVITRIFICATION, the slow cooling of glass causing crystalline aggregates to separate within the glass mass. The composition of the glass in this case is improperly balanced, for if glass has the proper composition, its rapid working and cooling will result in a non-crystalline mass.

BIBLIOGRAPHY.—Hodkin and Cousen, *Textbook of Glass Technology*.

DEVOLUTION, THE WAR OF (1667-68), the first attempt by Louis XIV to so extend the frontiers of France by conquest that they would coincide with the "natural boundaries." In 1665 Philip IV of Spain had died, leaving his territories which included the Spanish Netherlands to the son of his second marriage, Charles II, a mere child. Louis XIV had married Maria Theresa, eldest daughter of Philip IV by his first marriage. On behalf of his wife, after the death of her father, Louis XIV set up a claim to the Spanish Netherlands, insisting that since it was customary in that area for children of the first marriage to inherit property to the exclusion of those of a second marriage, the same rule should be applied to the whole country, and it should be given to Maria Theresa. The argument was flimsy, but Louis XIV had his lawyers write a book which proved his case to his own satisfaction, at least.

Having secured the neutrality of states likely to interfere, and believing that England and The Netherlands were too deeply involved in a trade war with each other to intervene, Louis XIV in 1667 announced

that he was going to take a journey into the Spanish Netherlands, as if they were an acknowledged part of his territories. With little opposition the magnificent French army built up by Louvois seized the Spanish lands bordering on France. It seemed as if Spain under its child king would have to relinquish its control of part of The Netherlands.

At this point, however, the Dutch, preferring a weak Spanish neighbor rather than a strong French one, woke into action. Under the leadership of the Republican patriot, John de Witt, they settled their difficulties with England, and formed a triple alliance with Sweden and England to resist the French encroachments, as a threat to the European "balance of power." The new diplomatic alignment was strong enough to thwart Louis XIV at least temporarily. Reluctantly he agreed to a peace, and in the spring of 1668 the treaty of AIX-LA-CHAPELLE was signed, by which Spain surrendered to France a strip of land along the French border which included such important frontier cities as Charleroi, Tournai and Lille, but kept the rest of the Spanish Netherlands. Angered by the turn of events, Louis XIV began to lay new plans which were to make the War of Devolution seem like a mere prelude to the Dutch War which began four years later. C. W. C.

DEVONIAN PERIOD, known sometimes as the Age of Fishes, the fourth period in the PALAEZOIC ERA of geological history. It is marked also by the first appearance of land plants.

DEVONPORT, a seaport and garrison town of Devonshire, England, situated upon a peninsula between Stonehouse Pool, and the Hamoaze, an estuary of Plymouth Sound, 234 mi. southwest of London. Now a unit with contiguous Plymouth and East Stonehouse, Devonport originated in 1689 as a royal dockyard. The old town has been largely razed for parade grounds and parks, and the town and military buildings are modern. Important as the anchorage of the British Home Fleet, Devonport also accommodates extensive foreign and coastal shipping. Pop. 1931, 2,400.

DEVONSHIRE, DUKES OF, titular heads of the Cavendish family. The original William Cavendish (1505-57) was a small landowner in Suffolk. He assisted Thomas Cromwell in the suppression of the monasteries and greatly enriched himself by acquiring land. Under the influence of his third wife, the masterful Bess of Hardwicke, he concentrated his property in Derbyshire and founded the original Chatsworth, which was rebuilt in the 17th century. His second son, William, was created Earl of Devonshire by James I in 1618. The third Earl of Devonshire was born in 1640 and died in 1707. It was he who raised an insurrection in favor of William of Orange in 1688, and his reward was a dukedom, conferred by King William six years later.

The Cavendishes have been, therefore, a Whig family. The fourth Duke (1720-64) was Prime Minister for a few months in the years 1756-57. The eighth duke, Spencer Compton Cavendish (1833-

1908) was known for thirty-three years as Marquis of Hartington. In 1874 he took Gladstone's place as leader of the Liberal Opposition in the House of Commons against Disraeli and six years later he was offered the premiership by Queen Victoria but refused. In 1886 he broke with Gladstone over Home Rule and as a Liberal Unionist joined Lord Salisbury in political association. Five years afterward he became Lord President of the Council but declined to accept Tariff Reform advocated by Joseph Chamberlain, and resigned office in 1903 and died Mar. 24, 1908. He was succeeded by his nephew, born in 1868, who, after holding various offices, served as Governor General of Canada from 1916 to 1921.

DE VRIES, HUGO (1848-), Dutch botanist, was born at Haarlem, Feb. 16, 1848. In 1878 he became professor of botany at Amsterdam and began investigating the development of plant species. In this he was the founder of the theory of mutation. He likewise investigated the structure of the plant cell and the processes of osmosis and plasmolysis in plants. In 1900 De Vries revealed to the scientific world the importance of the work of Gregor Mendel, whose researches in heredity had until then remained unnoticed, and thereby greatly advanced the study of genetics and its practical application to plant and animal breeding. *See also MENDELISM.*

DEW, little drops of water formed upon all objects near the ground by the condensation of the moisture in the atmosphere during the night. It is especially plentiful during clear, quiet nights after a hot day when solid objects can freely radiate away the heat they have received and stored up during the day. In the process of doing this they cool off so quickly that the temperature of the air with which they are in contact is lowered below the "dewpoint," that point where the amount of moisture present would constitute saturation, with the result that the excess water vapor condenses in drops.

After a warm, rainy day, when the air is nearly saturated with moisture, dew may begin to form directly after sunset, but is usually at its heaviest shortly before sunrise, when the lowest temperature of the night is reached. When clouds are present they reflect the radiation back to the ground to such an extent that the cooling process is retarded and dew does not set in. Wind likewise prevents the formation of dew by mixing the air and thus not allowing any layer to become sufficiently cooled for the water vapor to condense. Substances that absorb and radiate heat very easily cool off much more rapidly at night than do less perfect radiators, hence dew is formed much more quickly on metals than on wood. Sometimes, when the amount of moisture in the air is small the dewpoint is not reached until the temperature has dropped below the freezing point, and instead of dew there is formed HOAR FROST.

In regions where the humidity of the air is not too small, but where clouds are not formed often enough to produce sufficient rain for agricultural purposes, the regular, nightly formation of dew may

be adequate to sustain vegetation of some kind. It is estimated that the total amount of dew deposited annually on the earth corresponds to more than one inch of rainfall.

W. J. L.

DEWAR, SIR JAMES (1842-1923), English physicist, was born at Kincardine, Scotland, Sept. 20, 1842. He was professor of natural philosophy at Cambridge in 1875-77 and in the latter year was appointed to the chair of chemistry at the Royal Institution, London. He was knighted in 1904. Devoting himself to problems of liquefaction of gases, and to the investigation of low temperatures, he obtained a reading of -260°C . He invented the vacuum or thermos flask and, with Frederick Abel, produced cordite. Dewar died at London, Mar. 28, 1923.

DEWAR FLASK. See **VACUUM FLASK**.

DEWBERRY, a name popularly applied to various trailing varieties of blackberries with perennial roots and woody biennial stems. The wild American dewberry (*Rubus flagellaris*), common in neglected and mismanaged lands, in the eastern United States, has produced several superior varieties of which the most widely cultivated are Lucretia and Bartel, best known in the North; Manatee, in the South; and Skagit Chief and Mayes in the West. The Lucretia has been known since about 1860 but much spurious stock is offered for sale, probably unwittingly. Unlike bush blackberries, dewberries propagate themselves in the same manner as black raspberries, that is, by means of stem tips which layer themselves in the ground. Dewberries for the market are grown under the same conditions as blackberries but require stakes or trellises to keep the vines off the ground so that cultivation may be given and the fruit conveniently gathered. See also **BLACKBERRY**; **RUBUS**.

DE WET, CHRISTIAN RUDOLF (1854-1922), Boer general, was born at Leeuwkop, Orange Free State, Oct. 7, 1854. He saw service in the first Boer war, 1880-81, and was elected to the Free State legislature in 1897. In the South African War, 1899-1902, he was recognized as the boldest and quickest of the Boer leaders. He assisted in arranging the peace terms, raised money in Europe for needy Boer families, and wrote a book, *The Three Years' War* (1902). In 1907 he became a member of the first legislature of the Orange River Colony, serving also as Minister of Agriculture. Taking advantage of the World War he rebelled in 1914 against British rule and was taken prisoner. He was convicted of treason and received a sentence of six years with a fine of £2,000; on forswearing future political agitation he was, however, released the next year. He died at Bloemfontein, Feb. 23, 1922.

DEWEY, CHARLES MELVILLE (1849-1928), American landscape painter, was born in Lowville, N.Y., July 16, 1849. He studied in Paris under Carolus-Duran, with whom he painted a ceiling in the Louvre. He returned to New York in 1878 and specialized on landscapes. Among his works are *Indian Summer*, *A November Evening*, *The*

Brook, *The Harvest Moon* and *The Close of Day*. Dewey achieved his most poetic effects in landscapes depicting the subdued light of evening or dawn. He died Nov. 4, 1928.

DEWEY, GEORGE (1837-1917), American admiral, was born at Montpelier, Vt., Dec. 26, 1837. Graduating from the U.S. Naval Academy at Annapolis in 1858, he fought in the Civil War under Admiral Farragut, and was made lieutenant-commander in 1865. He was commodore in 1898 at the outbreak of the Spanish-American War. Dewey was placed in command of the Asiatic squadron, and on May 1, he destroyed the Spanish fleet in Manila Bay, for which exploit he was raised to the rank of rear-admiral. His fleet took part, with the army, in the capture of Manila. On Mar. 3, 1899, he received the rank of "Admiral of the Navy," a title never before bestowed. Dewey acquired great popularity for his exploits and, upon his return, Oct. 3, 1899, received a tremendous welcome, especially in New York City, where a "Dewey Arch" had been erected, designed by the best American sculptors. By a special government provision which abrogated usual custom, Admiral Dewey was not retired, but served as president of the General Board of the Navy until his death, Jan. 16, 1917.

DEWEY, JOHN (1859-), American philosopher, psychologist and educator, was born at Burlington, Vt., Oct. 20, 1859. He graduated from the University of Vermont in 1879 and received his Ph.D. from Johns Hopkins in 1884. From 1884-88 he was instructor in philosophy in the University of Michigan, and from 1888-89 professor of philosophy in the University of Minnesota. From 1894-1904 he was professor of philosophy and from 1903-04 Director of the School of Education in the University of Chicago. Dewey was professor of philosophy in Columbia University from 1904-30. At the age of 70 he became active in the formation of a third political party that would bring together the liberal elements of the country. Wherever the liberal and humanizing spirit is trying to assert itself, there will Dr. Dewey's influence be found.

Dewey's first work was his *Psychology*, 1886. This was written from the standpoint of Hegelian logic, and although Dewey has traveled a long way from Hegelianism, nevertheless some of the germs of his later ideas may be found in this work. Perhaps no single book has done more to influence education in recent years than *The School and Society*, 1899. His contributions to *Studies in Logical Theory*, 1903, were supplemented by additional essays and published in the *Essays in Experimental Logic*, 1916. These form the backbone of instrumentalism. The analysis of a complete act of thought in *How We Think*, 1910, has become fundamental to pedagogical and logical procedure. *Democracy and Education*, 1916, has become the guide to modern educational philosophy. The most systematic presentation of Dewey's metaphysics is given in the *Carus Lectures on Experience and Nature*, 1925. His other works include: *German*

Philosophy and Politics, 1915; *Reconstruction of Philosophy*, 1920; *Human Nature and Conduct*, 1922; the Gifford Lectures on *The Quest for Certainty*, 1929; *Philosophy and Civilization*, 1931, and *Ethics* (with J. H. Tufts), 1908.

Since James's death Dewey has been the accepted leader of the pragmatists. Central to his philosophy is the idea of the problem. Originally interested in moral problems, he developed a method for their solution that could be carried over into science. This became the instrumental logic. But in order to make it socially fruitful it was necessary to invade the realm of education. This he did by showing that the same method which the scientist applies in the pursuit of truth is the most effective and intelligent way of learning. It may take a more simple form, but essentially it is the same kind of process. As the problem sets the stimulus for thought, so thought becomes the means for controlling experience. Through the use of intelligence man can fashion the world more to his liking. Reflective thought as an instrument of control can render existence more stable.

DEWEY, MELVIL (1851-1931), American librarian and educator, was born at Adams Center, N.Y., Dec. 10, 1851. On graduating from Amherst College in 1874, he was made acting librarian for two years. He founded and for a time managed the American Library Association, the Metric Bureau for Establishing Metric Weights and Measures and the Spelling Reform Association. He was the founder and from 1876-81 editor of the *Library Journal*. His *Decimal System of Classification*, first published in 1876, is used in most American libraries and extensively in foreign countries. Dewey was the chief librarian and professor of library economy at Columbia University 1883-88. In 1884 he founded the School of Library Economy which, during his term, 1889-1900, as secretary and executive director of the University of the State of New York, was moved to Albany and became the New York State Library. He was the director of this library 1889-1906. Dewey died in Lake Placid, Fla., Dec. 26, 1931.

DEWING, THOMAS WILMER (1851-), American painter, husband of Marie Oakley Dewing, was born in Boston, May 4, 1851. He studied under Lefebvre in Paris and located in New York as a painter of portraits and figure compositions in 1879. His painting, *The Days*, won the Clark Prize in 1887. Among his works are *The Lady in Yellow*, *The Lady in White*, *The Letter* in the Metropolitan Museum, New York; *The Recitation*, *The Lady in Green and Gray*, Art Institute, Chicago; *Summer*, National Gallery, Washington; and 20 paintings in the Freer Collection, Detroit.

DE WITT, JOHN (1625-72), Dutch statesman, was born at Dort, Sept. 24, 1625. He studied at Leyden and traveled extensively. He was appointed pensionary of Dort and in 1653, grand pensionary of Holland. De Witt prevented the union of Holland and England, strengthened the financial position of

Holland, and expanded her trade with the East Indies. Among his achievements were the Act of Seculsion, 1654, and the Eternal Edict for the republican administration of Holland, 1667. When William III was called back in 1672, he resigned and soon after, being suspected of conspiracy against the prince, he was killed by an impassioned mob, Aug. 20, 1672.

DEW-POINT. See **HYGROMETER**; **DEW**.

DEXTRIN, a carbohydrate prepared commercially by heating dry **STARCH** alone, or after sprinkling it with nitric acid, to temperatures of 100° to 250°C.; it has the general formula (C₆H₁₀O₅)_n. It is brown in color and varies widely in composition, being a mixture of true dextrin, soluble starch, **GLUCOSE** and possibly unaltered starch. It contains about 12% of moisture and 0.2% of mineral matter. Dextrin is not soluble in alcohol; it is only slightly precipitated from solution by tannic acid and is not readily salted out by electrolytes. Although the dextrinizing treatment must cause a profound alteration in the structure of the starch granules, no change is visible until water is added, when the granules completely dissolve. Dextrin is used in textile finishing and printing (see **PRINTING**, **TEXTILE**) to impart a hard finish to the cloth.

In medical preparations, dextrin is substituted for acacia and other gums as suspending agents in the making of emulsions and mixtures. It is also employed as a mucilage, particularly for making medicinal pastes to be used in skin diseases. It is used as the glue on postage stamps and envelopes. See also **CARBOHYDRATES**.

DEXTROSE, a kind of sugar, known chemically as a six carbon monosaccharide (see **CARBOHYDRATES**) having an aldose reducing action. The lactone ring is connected to the first and fourth carbons, and there are some indications of other lactone groupings. Dextrose exists in two common isomers, the *alpha* and *beta* forms. The alpha form is found in two crystal modifications, the anhydrous and the hydrate, the latter having one molecule of water of crystallization. The beta form is found in only one crystal form, the anhydrous.

Dextrose is the most widely distributed of all known sugars and exists in practically all plants and in the blood of all animals. Its condensation products are even more widely distributed, as it is the condensing unit in starches (see **STARCH**), **CELLULOSE** and similar vegetable products. Its condensation with other sugars forms a widely distributed family of glucosides (see **GLUCOSE**) which unite with such products as phenol, alcohol, aldehydes, acids and oxycumarin derivatives, to form the essential alcoholoids, esters, and the like.

Its manufacture is briefly as follows: Starch milk is introduced into a bronze vessel containing water and hydrochloric acid. It is pasted by boiling during the period of introduction and is hydrolyzed at about 45 lbs. gauge pressure, when it is discharged into neutralizers, soda ash being added to remove the mineral acid introduced. The oil is skimmed off in large centrifugal separators; protein and cellulose are

removed by filtration over cloths; color and colloidal materials are removed by a heavy and light carbon treatment; and the refined liquor, when making hydrates, is boiled blank; that is, no crystals are introduced in the final evaporation. The boiled concentrated liquor is introduced into a crystallizing vessel upon a portion of a previous batch. After crystallizing the mass containing hydrate crystals is centrifuged and washed. The mother liquor is returned to the refinery for further refining and another boiling, and a soft yellow sugar is produced from it by a process similar to that described above. The final mother liquor is used as a source of sugar for food-stuffs and fermentation products.

The anhydrous sugar is boiled to grain in a vacuum pan, as described under the manufacture of cane sugar, and is then centrifuged and washed. Beta anhydrous is prepared by boiling to grain a high purity dextrose solution. All three dextrose sugars, after centrifuging, are dried by hot air in rotating cylindrical dryers, screened and packed.

Dextrose is used to displace part of the cane sugar in the manufacture of food products, either to give the product certain desired characteristics or to obtain the required amount of sugar without making the product too sweet, dextrose being less sweet than cane sugar. *See also* CARBOHYDRATES; SUGAR; Chemistry; SUGAR CANE, MANUFACTURE OF. W. B. N.

Dextrose is largely used in medicine in the form of solutions of varying concentrations as readily absorbable food, and in the form of injections to sustain blood volume and produce diuresis. Either alone or with other substances it is the ingredient of many sclerosing solutions for use in treatment of varicose veins. P. N. L.

DHEGIHA, a name applied to a group of Siouan Indian tribes, including the Omaha, Ponca, Osage, Kansas and Quapaw. These are further classified into two sub-groups: the lower Dhegiha, to which only the Quapaw belonged, and the upper Dhegiha, which included the other tribes named.

DHOW. *See* BOAT.

DIABETES INSIPIDUS, a rare chronic disease characterized by intense thirst and an excessive flow of urine, low in specific gravity, but otherwise normal. The excretion of urine is usually from 6 to 12 quarts, but may exceed 40 quarts a day. This great loss of fluid provokes extreme thirst and attempts to withhold fluids cause agonizing distress. The condition is distinguished from the polyuria of chronic NEPHRITIS by the absence of albumin and other abnormal urinary constituents, and from the polyuria of DIABETES MELLITUS by the absence of sugar.

The disorder is usually attributed to abnormality in a nervous center in the subthalamal region of the brain, although some cases are due to tumors in the abdomen which produce local irritation of the sympathetic nerves to the kidneys. The center in the subthalamus influences, through the nerve tracts, the capacity of the tissues to store water. This mechanism is probably abnormal at birth, in the so-called

primary cases, where no organic disease is demonstrable. In the secondary cases of cerebral origin, it may result from fracture of the base of the skull, from tumors in the neighborhood of the center or from infection, particularly, syphilis and epidemic encephalitis.

The nervous mechanism controlling water capacity is also influenced by the secretions of the PITUITARY GLAND (hypophysis) and remarkable benefit is obtained in cases of diabetes insipidus by hypodermic injections of extracts of the posterior and middle portions of the hypophysis. R. M. W.

DIABETES MELLITUS, a disorder of metabolism, which is the result of deficient production of the glandular secretion insulin. The source of insulin is the islet tissue of the pancreas. The disease is characterized by diminished ability on the part of the tissues to utilize sugar. The blood sugar fluctuates in health between 0.08 and 0.14 per cent. In diabetes it may exceed 1 per cent. The daily output of glucose in diabetic urine may reach 500 grams if the intake of food is unrestricted. Water is carried out with the sugar. The cardinal symptoms of diabetes, polyuria, thirst and emaciation, are thus accounted for.

When the sugar metabolism is markedly disturbed, abnormalities are also noted in the combustion of protein and fat, so that acetone, aceto-acetic acid and beta-hydroxybutyric acid are formed in large amounts. These substances appear in the urine and accumulate in the tissues. Acetone can be detected on the breath as a sweetish odor. The acids mentioned cause a shift in the direction of acidity in the reaction of the body fluids, provoking extreme drying of the tissues and causing an intoxication known as diabetic coma.

Occasionally, gross pancreatic lesions exist, lesions resulting from stones in the pancreatic ducts, tumors of the pancreas, infections or other causes. Complete destruction of the pancreas invariably provokes diabetes, as was first discovered in 1889 by v. Behring and Minkowski, but a large proportion of the total amount of its tissue may be injured without noticeable harm and the severity of a case of diabetes is often out of proportion to the damage visible. In cases with no evident organic lesion, a functional disturbance must be assumed. Other causative factors are overeating, race and heredity. The incidence of diabetes has increased enormously in the last few decades, paralleling a greatly increased sugar consumption; a relationship here is suspected, although not proved. Certain races, particularly the Jews and Hindus, are disproportionately affected, perhaps because of special food habits, possibly the result of inbreeding. Statistics of many authorities indicate an hereditary influence in 25 per cent of all cases.

Diabetes affects individuals of all ages, from infancy. Its severity is usually greatest in the young and untreated juvenile cases are almost invariably fatal within from a few weeks to two or three years. In its milder forms it may persist for decades without causing serious harm, although associated conditions, such as boils and other skin lesions, arteriosclerosis, arteriosclerotic

heart disease, neuritis, and cataracts are frequent accompaniments. In the more acute cases, death comes as a rule from diabetic coma; in the chronic cases, from complications due to arteriosclerosis. (*See also* COMA; PYORRHEA.)

The discovery in 1921 by Banting and his associates, Collip, Best and McLeod, of the method of isolating insulin, was recognized as a landmark of recent medical progress by the award of the Nobel prize. The preparation, now in use therapeutically, is obtained from the pancreas of slaughter house animals. It is highly purified and dispensed in solutions containing from ten to eighty units to the cubic centimeter. A standard unit effects an increased tolerance of from one to four grams of carbohydrate, depending upon the patient and the type of diet. Insulin must be injected subcutaneously. The search for a drug that will act by mouth has thus far been fruitless. The only preparation, other than insulin, that is at all beneficial in diabetes is a guanidine derivative named synthalin and this is not without injurious action on the liver.

The successful treatment of a more severe case of diabetes demands, not only continued injections of insulin in proper dosage, but also a rigid control of the intake of food. The amounts of sugar-forming materials must be held constant from day to day, otherwise over dosage with insulin is scarcely to be avoided. With good management, it is possible to maintain in perfect health patients with extreme grades of an otherwise fatal disease. *See also* INSULIN; METABOLISM.

R. M. W.

DIABLO, MOUNT, a mountain of the coast range of California, located in Contra Costa Co., 30 mi. slightly northeast from San Francisco. Though the mountain is of only moderate height, 3,849 ft. above sea level, its isolated position and extensive visibility have made it a famous landmark since the days of the forty-niners. The majority of the land surveys of California are reckoned from the meridian and base line of Mt. Diablo. Its geological formation indicates that it is the higher portion of an anticline of sedimentary rocks and not an old volcano as is popularly believed. Mt. Diablo is easily reached by excellent motor roads and is one of the leading scenic points of the state. From its summit on a clear morning the distant Sierra Nevada Mountains, Lassen Peak, and occasionally Mt. Shasta can be seen.

DIABLO DAM, located on the Skagit River, 100 miles northeast of Seattle, Wash., forms part of the comprehensive water power development of that river, and is notable as the highest arch dam in the world. It is 385 feet high above the lowest foundation level and about 335 feet above the bed of the river, while the cut-off wall extends 25 feet below lowest foundation level. It is 140 feet thick at the base and has a top length of 525 feet between the full gravity section spillway dams which form the abutments for the upper portion of the arch. The dam contains 316,000 cubic yards of concrete and creates a storage reservoir of nearly four billion cubic feet capacity.

DIACHRONIC GRAMMAR, study of the phenomena of language, whether in general, in specific families (*see* FAMILY, LINGUISTIC), or in individual languages, from the historic point of view, a complete diachronic grammar of LATIN, for example, tracing the development of Latin from its earliest records to its latest. Frequently, though not necessarily, it seeks also to explain linguistic phenomena and proceeds by the methods of comparative LINGUISTICS, with which, indeed, it often becomes identical. Ideally (and practically, wherever accessible data permit) it should be based on previous studies in SYNCHRONIC GRAMMAR.

DIAGONAL, a straight line joining any two non-consecutive vertices of a polygon or polyhedron. In the case of polyhedron, the vertices must not lie in the same face.

DIALECT, a sub-division of a language. Just as a LINGUISTIC FAMILY or a group of such a family, e.g., ROMANCE, is divided into a greater or smaller number of individual languages, so each of these usually shows a varying number of dialects, each divided into sub-dialects, and these still further divided. A language, indeed, in the conventional sense of the term, is merely a dialect which for some reason—religious, literary, economic, political, or social—has become the recognized standard form employed by those who speak that “language”; but in no case is it selected because of any intrinsic superiority over other dialects. Thus “French” is essentially the dialect of Paris because of the overwhelming supremacy of the city of Paris, not because its speech is in itself superior to that of Picardy, Touraine, or any other French area. Where there are several centers of much importance, there may be several dialects of high standing, as was the case with Attic, Doric, Ionic, etc., in Greece, until the political dominance of Athens made her dialect (Attic) synonymous with “Greek.”

Dialects may receive extensive literary cultivation, but tend in general to become mere local vernaculars, spoken especially by the less advanced members of the community; yet, on the other hand, a standard language is almost inevitably re-dialecticized. The literary language may itself become a type of dialect, written but not actually spoken except by pedants, as in the case of modern French. Each highly specialized profession has a sort of dialect of its own, especially in vocabulary; slang is a species of dialect, particularly when, as in the case of the criminal classes, it is formed expressly to be unintelligible to the great mass of the community. The extension of standardized education, intercommunication, and, in certain countries, military conscription tend to make dialects disappear; but the view that they are despicable and not to be spoken by the educated is mere snobbism; and they have a high linguistic value in preserving phonological phenomena, forms and words lost in the standard “language” itself.

L. H. G.

DIALECTIC, a form of argument or the art of disputation; the application of the forms of the understanding to the ideas of reason; the development of

thought. The first meaning is the Greek, the second Kantian and the last Hegelian.

Dialectic as a form of argument was used by both PLATO and SOCRATES for the purpose of developing concepts; as the art of disputation it was most cleverly mastered by the SOPHISTS and is well illustrated by the game the Greeks used to play, known as the "yes and no dialectic."

The Kantian meaning is technical, referring to the difficulties encountered by reason in its attempts to apply the categories of the understanding to things-in-themselves. The Hegelian dialectic is famous as the ladder of the natural development of thought. Its method is according to thesis, antithesis and synthesis.

DIALOGUE, a conversational discussion between two or more persons on a subject treated with greater formality than usual in customary speech. It was a favorite literary method with the Greeks, both SOCRATES and PLATO employing it for expounding their philosophical ideas. The form is particularly well suited for the interpretation of philosophy, but far less so for the exposition of any but the simplest and most concrete facts of science. Eminent writers of dialogue were ERASMUS, who wrote in Latin, MACHIAVELLI, FÉNELON, DIDEROT, BERKELEY, SWIFT and LANDOR.

DIAL SIGHT. See PANORAMIC SIGHT.

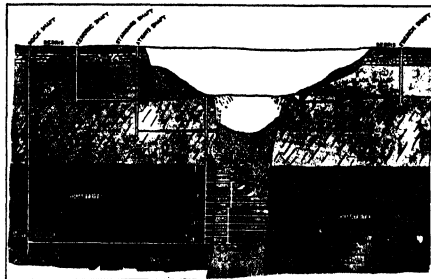
DIALYSIS, a word applied by Thomas Graham to "the method of separation by diffusion through a septum of gelatinous matter." Among the commonly used dialytic septa are parchment paper, bladder, porous porcelain and filter paper which has been made less pervious by gels of CELLULOSE ESTERS or of hardened GELATINE. Tannic acid passes through parchment paper about 200 times slower than sodium chloride; gum arabic, 400 times slower. "The separation of colloids from crystalloids by dialysis is, in consequence, generally more complete than might be expected from the relative diffusibility of the two classes of substances."

DIAMAGNETISM. See MAGNETIC INDUCTION.

DIAMOND, the most highly esteemed of all precious stones and the hardest substance known. Fine stones are remarkably clear and transparent, and the high refractivity and dispersion give the diamond brilliancy and fire. The ancient Greeks, in recognition of the diamond's preeminent qualities, gave it the name *adamas*, meaning unconquerable.

Both the diamond and GRAPHITE are crystalline forms of ordinary carbon, the former crystallizing in the ISOMETRIC SYSTEM and graphite in the HEXAGONAL SYSTEM. The commonest crystalline forms of the precious variety of carbon are the octahedron and dodecahedron. As found in nature they usually have a glassy or greasy appearance, and not until cut does the brilliant, adamantine luster of the diamond appear. Diamond fragments and crystals vary in size from microscopic to more than 3,000 carats in weight. (A Troy ounce contains about 155 carats.) Small diamonds have been produced synthetically but, thus far, their production has not proved practicable.

The deposits from which diamonds were first recovered were those of India and Borneo, where they occur in CONGLOMERATES and river gravels. About the year 1670 diamonds were identified in river washings for gold in Brazil, and a considerable production resulted. Approximately 90% of the world's supply,



FROM W. R. CRANE, ORE MINING METHODS, JOHN WILEY & SONS

SECTION THROUGH A DIAMOND MINE

Showing method of working blue ground "pipe" by caving

however, now comes from the South African mines near Kimberley. These were discovered in 1867 as the result of a hunter observing children playing with bright stones. The first diamonds were found in sands and gravels of stream beds, but three years later the primary deposits were located. These consist of vertical "pipes" or chimneys of "blue ground" or KIMBERLITE, a bluish PERIDOTITE altered to SERPENTINE. It probably welled up as a molten mass, or MAGMA, through fissures previously opened by volcanic action. The carbon, either originally in the magma or picked up in its passage through deep-lying carbonaceous shales, crystallized as diamond. The exact process is still a moot question.

At first diamond mining was by means of open pits but depths attained necessitated changing to underground methods used in metal mines. The blue ground is either allowed to disintegrate by WEATHERING when spread out on the surface, or is broken up mechanically. In either case the product is passed over greased, corrugated iron sheets, only the diamonds sticking in the grease. They are periodically scraped off, sorted, and made up into matched parcels. Six to forty stones are usually found per hundred cubic feet of rock, of which about 90% will be smaller than 10 carats. Only 3%, approximately, are "close goods" or best quality, and only half of these are fine white stones. The remaining stones are tinted yellow or brown, and are spotted, flawed or irregular. Occasionally fine yellow, green or blue stones are found, which are highly valued.

Poorly crystallized diamonds of a dark color, and often showing a radial structure, are called BORTZ. They are used in dies for fine-wire drawing, and powdered are employed in diamond polishing. CARBONADOS are opaque, black or gray diamonds which are tough and lack cleavage. They are used for diamond drills and lathe tools. Gem diamonds are brittle.

Peridotite plugs or pipes have been found in Arkansas, from which there has been some production of diamonds.

Diamonds are prepared for cutting and polishing by removing flawed portions by cleaving them. This is easily done since they possess a good octahedral cleavage. They are then mounted in wax on a small stick and held against a rapidly revolving wheel or plate on which diamond dust is sprinkled. The position is changed for each facet. The brilliant cut is most popular, as it gives the most fire.

The world's production in 1929 was 7,335,000 metric carats, valued at approximately \$70,000,000 in the uncut state. The world's production of these stones in 1930 was estimated by Dr. George Frederick Kunz, of New York, at 6,973,000 metric carats. *See also* ADAMANT; DRILLING; GEM STONES; MINERALOGY; MOISSANITE; PRECIOUS STONES; ZIRCON. S. F. K.

BIBLIOGRAPHY.—George F. Kunz, *The Curious Lore of Precious Stones*, 1913; Edw. H. Kraus and E. F. Holden, *Gems and Gem Materials*, 1925; J. R. Sutton, *Diamond, a Descriptive Treatise*, 1928.

DIAMOND MOUNTAINS, a range along the eastern coast of Korea, forming the backbone of the country. The core of the mountains is granite with tertiary beds prevailing near the coast. As it approaches the southern end of the peninsula, the mountain wall spreads out fan-wise into gentle elevations of 2,000 to 3,000 ft., making room for rich cultivated valleys. On the jagged cliffs, from which the mountains are named, there are several Buddhist temples and monasteries. Pirobong, 9,000 ft., is the highest peak.

DIAMOND NECKLACE, THE AFFAIR OF THE, a curious episode that did much to increase the unpopularity of Marie Antoinette shortly before the French Revolution. Cardinal Rohan was tricked by an adventuress, Countess de Lamotte, into believing that he was carrying on an intrigue with the Queen, whose ill-will he had incurred some time before. He was therefore persuaded to purchase a very valuable necklace, to be paid for in instalments. This the cardinal thought the Queen accepted, when in reality Mme. de Lamotte probably took it to England. When payments were not promptly made upon the necklace the jewelers took the matter to the Queen, whereupon the cardinal was arrested. He was tried by the Parlement of Paris and acquitted while Mme. de Lamotte was sentenced to whipping, branding and imprisonment. As the cardinal was banished from Court, however, and the countess was soon allowed to escape from prison, presumably through royal favor, the popular belief was strengthened that Marie Antoinette had allowed her hatred of the cardinal to lead her to connive in the intrigue.

DIANA, the Roman name for the Greek ARTEMIS, goddess of the moon and the hunt. She was daughter of JUPITER and LATONA and twin sister of APOLLO, and was born on the island of Delos. As goddess of childbirth she was worshiped as Lucina, and her maidens were virgins. In Rome her temple was on

the Aventine. She was considered the protectress of slaves. The goddess's priest at her temple at Nemi was always a runaway slave who obtained his office by killing his predecessor in hand to hand combat.

DIAPHONE. *See* FOG SIGNALS.

DIAPHORETICS, or SUDORIFICS, terms for sweat producing agents, which increase perspiration, so as to render it appreciable or "sensible." Heat is the great "natural" diaphoretic; for the chief function of sweating is to aid in maintaining normal body temperature by binding heat during its evaporation. Sweating results, no matter how the attack is made in the direction of increasing body temperature; whether by introducing hot fluid into the body, or by exposing the surface to a source of heat, or by lessening the heat loss by means of heavy coverings. Often all three methods are combined. Chamomile, linden and various other "teas" owe whatever therapeutic value they possess chiefly to the heat with which they are taken. Pilocarpine, an alkaloid of jaborandi, a South American shrub, acts in an entirely different manner. It stimulates the nerve endings to the sweat glands; but it also stimulates the salivary glands and is rather depressing, so that it is chiefly employed when heat alone does not suffice to induce sweating. The coal tar ANTIPYRETICS and the salicylates are very prone to produce sweating, generally, as an undesirable side-effect. The main therapeutic value of sweating lies in its lessening internal congestions by bringing blood to the skin. The power of sweat to carry off poisons is very limited. B. F.

DIAPHRAGM, a musculo-fibrous, dome-shaped partition separating the thorax from the abdomen. It is formed of radially arranged voluntary muscle fibers which converge to a central flat fibrous plate somewhat resembling a clover-leaf in shape. There are three large perforations in the diaphragm. Through one passes the vena cava, through another the esophagus and vagus nerves, and through the third the abdominal aorta and thoracic duct. The heart and lungs rest on its upper surface, while the liver, stomach and spleen are in contact with its lower surface.

The diaphragm is the chief muscle of respiration, especially in the male. Its contraction lowers the floor of the thoracic cavity, thereby increasing the volume of the lungs and drawing air into them. This accounts for the predominantly abdominal character of quiet respiration. It contracts with expulsive efforts such as coughing, laughing, sneezing, urination, and vomiting.

Hiccough is spasmodic contraction of the diaphragm.

DIAPHRAGM GAUGE. *See* PRESSURE GAUGE.

DIARRHEA, an intestinal condition in which there are frequent movements of the large intestine or colon, resulting in numerous evacuations from the bowel. There are many causes for frequent evacuations of the bowel, ranging from functional disturbances to those in which abnormal changes have taken place in the intestinal tract. The most common cause for diarrhea is dietary indiscretions in which wrong

or too much food is eaten or where foods are either improperly cooked or improperly digested. Nervous disturbances such as fright or fear frequently cause diarrhea. Acute infectious diseases associated with fever are frequent sources of diarrhea. Such diseases as typhoid and dysentery have diarrhea as a common manifestation. These frequent movements of the large bowel are often seen in patients who have not the necessary amount of digestive juices in the stomach, as in pernicious anemia. Disturbances of other organs of digestion—notably the pancreas—also cause frequent movements. Diseases of the large bowel (whether they be ulcerative diseases, like bacillary or amoebic dysentery, or ulcerative lesions of the non-specific or tuberculous type) and cancer often have diarrhea as their most prominent symptom. In cancer one frequently sees an alternating constipation. The typical summer diarrheas, especially in children, are usually associated with some water or food-borne infection and very often are due to the bacillus of dysentery. (See also DYSENTERY)

Patients suffering from diarrhea may complain of nothing other than the mere inconvenience of going to stool at frequent intervals, or they may complain of symptoms of cramp-like pain, severe colic, straining at stool and, very often, there is associated with it a marked weakness, and inability to work. Occasionally, with this, they may or may not lose weight, depending upon the nature of the disease. The stools may be watery and contain large amounts of mucous or white, string-like material. They may also contain pus or blood, the latter being especially true in the ulcerative conditions. In the febrile diseases there is usually an accompanying fever and the patient may even be bedridden. From the frequent stools, they may have pain and burning about the rectum. It is noteworthy that when the diarrhea originates in the small bowel, there is less cramp and pain in contradistinction to large bowel diarrhea.

The most important factor, before any case of diarrhea can be treated, is to know the exact cause and it is especially important to know if there is an acute surgical process in the abdomen, as occasionally acute APPENDICITIS may be accompanied by diarrhea.

Having once either removed or isolated the cause, these patients do much better on the foods that give very little or no residue in the bowel. Such irritants to the intestinal tract as fruits and coarse vegetables aggravate rather than quiet the rapid movements. Rest in bed is beneficial but not essential. Occasionally, hot applications to the abdomen are of distinct value. As a rule, where the diarrhea is purely transient, the individual mends without any radical treatment when the specific causative factor has been removed. The more protracted cases, however, may require a vigorous medical, as well as dietary, management. See also CHILDREN, DISEASES OF: Digestive and Nutritional Disturbances of Infancy; PARASITIC DISEASES. S. A. P.

DIARRHEA, WHITE, the most destructive of all poultry ailments, causing an estimated loss of

50% of chickens hatched in the United States. Affected chicks appear stupid, eat little or nothing, steadily lose weight, their feathers become rough and the characteristic whitish discharge from the vent soon appears. The chicks often chirp or peep constantly as if in pain. Efforts should be directed toward prevention rather than cure.

DIARSENOL. See ARSPHENAMINE.

DIARY, a daily record kept by an individual of personal deeds, transactions and observations. Its entries are generally of a more commonplace character than those of a journal, and a diary may be nothing more than a convenient record of business transactions, social engagements and the like. The *ephemeros* of the ancient Greeks was often a diary of military events, and diaries of some sort have been kept through the ages. It was after the Renaissance that diaries first began to have a commanding value as literature and as historical documents. The great diaries of the 17th century, those of JOHN EVELYN (1620-1706) and SAMUEL PEPYS have thrown much light on the life and manners of the times, and the diaries of JOHN WESLEY have done a similar service for the 18th century. Notable diaries of the 19th century include those of Sir Walter Scott, Thomas Moore, Crabb Robinson, Marie Bashkirtseff, Charles Darwin and the French diaries of Jules and Edmond de Goncourt. The diaries of Tolstoy have been widely read.

DIAS, BARTHOLOMEU (c. 1450-1500), Portuguese explorer and skilled navigator, born in the 15th century. In 1487, John II of Portugal sent him in command of three ships to continue explorations along the west coast of Africa. While on this mission he was driven south by a storm and discovered the Cape of Good Hope and an ocean route to the Indies. In Dec. 1488, after exploring part of the eastern coastline of Africa, he sailed back to Lisbon. He was with the expedition of Cabral when he discovered Brazil, and on the return voyage he was lost at sea in a storm in May 1500.

DIAS, GONÇALVES (1823-64), one of the leading Romantic poets of Brazil, was born in 1823. Representing the naturalistic strain, he was the first to reveal to his countrymen the full significance of national pride. In him flowed the blood of all three races that make up the Brazilian blend. In *Os Tymbiras* he has celebrated the Indian; in *A Escrava*, the African; in the *Sextilhas de Frei Antônio*, the Portuguese. It is with the name of Gonçalves Dias that Indianism in Brazilian poetry is most intimately associated. At times his Americanism became a blind hostility to Europe. His most famous poem is the *Canção de Exílio*, or *Song of Exile*, which at once captured the imagination of his people and became the property of the nation. The *Song of Exile* has been a powerful influence not only in the national life, but upon most of the poets who followed upon Dias. The poet died in 1864.

DIATHERMY, the application of heat to body tissues, through which a high frequency electrical

current is passing. Electrical energy is converted into heat energy when electrical currents flow through tissues. This physical phenomenon obeys Joule's Law, that is, heat produced in a conductor is proportional to the square of the current and the resistance. High frequency electrical currents of approximately 750,000 to 3,000,000 oscillations per second, as commonly employed, have such rapid oscillations that living tissues do not contract with each alternation, and therefore no sensation aside from heat is experienced.

Nikola Tesla, an American electrical engineer, receives credit for first suggesting the use of high frequency currents in medicine. D'Arsonval, a French physicist, (1888-1890) in honor of whom the high frequency current is named, first reported research on the application of this current, as well as other currents, in medicine. Nagelschmidt (1907), a German physician and coiner of the word "diathermy," introduced the idea of applying D'Arsonval current to the human body for treatment of various types of arthritis.

When heating tissues to a temperature insufficient for destruction but sufficient for therapeutic effect, the application is known as medical diathermy. All authorities agree on the term "medical diathermy" regardless of the exact voltage or current utilized, provided the application of D'Arsonval current is by means of two electrodes. It is used as an adjunct in the treatment of diseases which are amenable to heat therapy. Medical diathermy has been useful in the partial control of pain in spasm, swelling in joint injuries and arthritis, and to produce therapeutic fever. (See also PARESIS.)

If the amount of heat is sufficient to destroy tissues by electrocoagulation or electrodesiccation, the application is called surgical diathermy. Nagelschmidt limits the term "surgical diathermy" to bi-polar electrocoagulation. Electrodesiccation dehydrates the tissues utilizing but one electrode, the needle, whereas electrocoagulation destroys tissues and employs a needle and an indifferent electrode. Electro-cutting currents separate the tissues with minimum destruction of cells and require two electrodes. The high frequency knife will close small capillaries, thus preventing loss of blood. Electrodesiccation and electrocoagulation have been found useful in removing tumors, malignant growths, and tonsils. Cutting currents are now being applied experimentally to remove cancerous tissues.

Modern diathermy machines generate as high as 7 amperes (7,000 milliamperes) under satisfactory conditions at a frequency controllable by the operator. Definite frequencies considered the best for generation of heat are not known, but in practice the most satisfactory frequency is the one producing electrical resonance for the particular impedance of the high frequency circuit, the impedance of the body tissue under treatment. According to laws of oscillating electrical circuits, maximum current flows when the entire circuit is in electrical resonance.

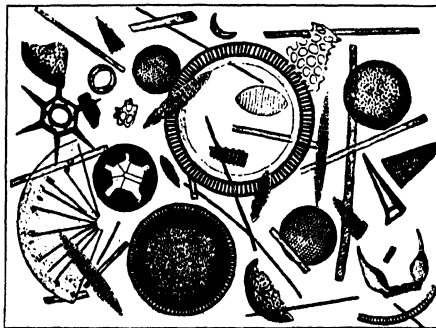
The essential elements of the modern diathermy

machines are: a step-up transformer, condenser, spark gap, high frequency transformer, and electrodes. These electrical devices are connected in proper sequence which is comparable to the original Tesla coil electrical machine. Thermionic tubes are being used experimentally to produce high frequency currents for both diathermy and therapeutic fever.

H. A. C.

DIATOMACEOUS EARTH. See DIATOMITE.

DIATOMITE, a soft, pulverulent rock, white, yellow or gray in color, which superficially resembles CHALK and KAOLIN. It is composed of the siliceous



FROM KRÜNNEL'S OCEANOGRAPHIE

DIATOM SKELETONS AND SPICULES

(OPAL) skeletons secreted by microscopic forms of aquatic plants known as **DIATOMS**. Deposits are still forming but the important beds of diatomite, or diatomaceous earth are Tertiary. In the United States, California, Nevada, Connecticut and Maryland produce diatomaceous earth. It is used as an abrasive and polishing agent, a filtering medium, an absorbent, and for heat insulating. See also SILICA; TRIPOLI.

DIATOMS, a large family of one-celled algae, found in fresh and sea-water, the beautifully sculptured cell-walls of which absorb considerable silica. While more or less slimy when alive, the skeletons of these plants are abrasive, fossil remains of them constituting diatomaceous earth. The cell wall is divided into two halves not unlike the two parts of a pill box. While many of the organisms are completely solitary others are found in considerable colonies. Diatoms occur in enormous numbers and furnish food for some of the shellfish.

N. T.

DIATONIC SCALE, in music, seven musical tones falling within the compass of an OCTAVE and forming a series of five whole-tones and two half-tones. In a major key, the half-tones occur between the third and fourth, and between the seventh and eighth steps of the series. Opposed to the diatonic scale are the HARMONIC MINOR SCALE and the CHROMATIC SCALE. See also INTERVAL; MODE; SCALES, MUSICAL.

DIAZ, ARMANDO (1861-1928), Italian marshal, was born at Naples, Dec. 6, 1861. His brilliant service

in the Italo-Turkish war resulted in his being made director of military operations when Italy joined the Allies in the World War. In 1917 he replaced Cadorna as chief of the general staff. His reconstruction of the battlefield after the defeat of Caporetto and his victories over the Austrians in 1918 brought him great honors. After the armistice he was created Duca della Vittoria. He was Minister of War in the first Fascist Cabinet, and the rank of Marshal was created for him in 1924, when he retired because of ill health. He died in Milan, Feb. 29, 1928.

DIAZ, JOSÉ DE LA CRUZ PORFIRIO (1830-1915), Mexican statesman, was born at Oaxaca, Sept. 15, 1830. Under the influence of Benito Juárez, he studied law. He fought in the war against the United States, 1847-48, was active in support of Juárez's Presidency and in opposition to the French invasion, and when the French withdrew in 1867, was the leading republican general. He opposed Juárez, however, in 1871, and in 1876 established himself, by revolt, in the Presidency. Except for a short interval, 1880-84, during which he was for some time a Cabinet Minister, Diaz remained President through 35 years. A great statesman, he brought Mexico order, prosperity, and esteem among nations; but his despotic rule culminated in revolution in 1911. Diaz resigned and went to Europe. He died in Paris, July 2, 1915.

DIAZ DE LA PEÑA, NARCISSE VIRGILE (1807-76), French landscape painter, was born at Bordeaux in 1807 of Spanish parents. After a wretched youth, which culminated in the loss of a leg, he was apprenticed at Sèvres to a porcelain factory. From china painting he turned to brilliantly colored canvases of Eastern subjects. Admiration for Theodore Rousseau turned him from figure to landscape painting and led him to the Forest of Fontainebleau, where the great interpreter of trees taught him devotedly. This friendship with Rousseau resulted in fine, tonal transcriptions of storms and forest scenes which rank with the best works of the BARBIZON SCHOOL. Diaz died at Mentone, Nov. 18, 1876.

DIAZ DEL CASTILLO, BERNAL (1492-1581), a Spanish soldier and historian, born at Medina del Campo. He came to America with Pedrarias Davila in 1514 and subsequently served in the expedition led by Cortes for the conquest of Mexico. During his long career he fought in 119 battles. His principal claim to fame is not, however, in his military exploits, but in the record he left of them. To answer the histories of Francisco Lopez de Gomara and others who had praised Cortes, he undertook to write *A True History of the Conquest of New Spain*, glorifying the share of the common soldier in the conquest. His *True History* begins with his arrival in America, in 1514, and finishes in 1568. Since its publication in 1632 it has been considered one of the most authentic and complete accounts of the conquest of Mexico.

DIAZO-COMPOUNDS, a large and important class of organic substances, typified by the presence of the group, $-N=N-$, and distinguished from the AZO-COMPOUNDS in that the former have an organic

radical attached to only one of the nitrogen atoms, the other being generally united to oxygen, nitrogen, or an acid radical. The simplest aliphatic diazo-compound (see ALIPHATIC COMPOUNDS) is diazomethane, a heavy gas with strong toxic properties. The aromatic diazo-compounds, which are by far the more important, since they form the basis of valuable groups of azo-dyes, are generally prepared by the action of sodium nitrite upon amines of the benzene and naphthalene series. The first product formed is generally a diazonium salt, such as benzenediazonium chloride, $C_6H_5N=NCl$, produced in the reaction between aniline hydrochloride and nitrous acid; when isolated, these diazonium salts are generally crystalline substances with explosive tendencies, and are soluble in water, by which they are strongly ionized. In the synthetic manufacture of dyes (see DYES, SYNTHETIC), however, they are almost invariably transformed again by the addition of, and the action upon, other aromatic compounds, the entire process being known as diazotizing. This process sometimes takes place on the fabric itself, after it has been impregnated with one of the participants in the reaction. By further treatment, the diazo-compounds may be transformed into triazo-compounds, containing the characteristic group, N_3 , to which is attached one monovalent radical. The first diazo-compound was discovered in 1858 by an English chemist working in a brewery. W. J. L.

DIBRA. See DEBAR.

DICE, cubes made of ivory, wood, metal, or other substance, used in a variety of games of chance. They have a long history, indicated by their repeated discovery among buried relics in Egypt, Greece and the Orient. The original dice were probably knucklebones, with which paleolithic man may have played a crude form of Odd and Even. Herodotus suggests that the first systematic dicing with six-sided dice was of Lydian origin. Other records give credence to the belief that the Greeks invented the modern marking, i.e., an arrangement by which the total of any two opposite surfaces is seven. Certain writers have attempted to attribute the invention of dice to Palamedes (about 1244 B.C.); but there is little doubt that the gaming cubes antedate the Greek and contemporary civilizations by many centuries. The modern games for dice include BACKGAMMON, Vingt-et-Un, Going to Boston, and the almost universal Craps.

DICHOGAMY, a term first employed more than 100 years ago to designate the condition of an hermaphrodite flower when its two kinds of sex organs (pistil and stamens) mature and function in different intervals of time. It is now to be recognized that dichogamy may operate in sets of flowers, in all the flowers of each sex in monoecious plants, in a plant as a whole, in groups of plants, and in the plants of each sex in a dioecious species.

In the simplest type of dichogamy in flowering plants the flowers are all alike for all plants of the species and the sequence in them may be either male-female (protandry) or female-male (protogyny). If

the dichogamy is complete for each flower there can be no self-pollination, but if there are numerous flowers opening in succession on the same plant there can be close-pollination except for a time in the end-periods of the flowering when the flowers then open can function only in cross-pollination. A further development is seen in heterodichogamy in which some plants of the species have protandrous flowers while others have protogynous flowers; and this condition allows for reciprocation in cross-pollinations between the two groups of plants especially during the end periods. In a few species as in the SKUNK CABBAGE heterodichogamy may operate in the development of the various flowers on a single plant.

The extension of end-period dichogamy to a complete seasonal dichogamy for a plant as a whole is accomplished in certain monœcious plants, especially in certain pecans, walnuts, hickory nuts and hazel nuts, in which the flowers of one sex develop before those of the other sex on the same plant. Here, also, the sequence may be male-female or female-male, and all plants of a species may have one sequence or there may be two groups, one with seasonal protandry and the other with seasonal protogyny. In chestnuts there are two end-season periods of pollen shedding with a mid-period when pistillate flowers are mature; a condition called duodichogamy.

In diœcious plants the individual is unisexual, but in certain species, as of *Salix*, the flowers of the plants of one sex mature before the flowers of the plants of the other sex do, even when both are growing in the same locality. This restricts reproduction within the species and promotes hybridization.

The most complex development of dichogamy now known is seen in avocados. The flowers are hermaphrodite, rather simple and uniform in structure, and protogynous. For each flower there are, normally, two distinct periods of anthesis, and the flowers open and close in sets synchronously. There are two main types of daily sequence in the dichogamy. For one group of plants the flowers of a new set open for the first time in the morning, function as females that forenoon and close during midday. These flowers are open again during the afternoon of the next day when they shed pollen. The succession of sets gives a daily sequence in which the entire tree functions as a female in the forenoon and as a male in the afternoon. For the trees of the other group the sets of flowers open for the first or female anthesis in the afternoon and for the second or male anthesis in the forenoon of a later day and in the succession of sets the daily sequence is male in forenoon and female in the afternoon. The dichogamy in individual flowers limits or prevents self-pollination, the synchronous alternation limits or prevents close-pollination, the similar sequence limits and prevents inter-group cross-pollination between different seedlings of the same group, but there is a double daily reciprocation between members of the two groups with respect to inter-group cross-pollination.

Dichogamy is complete or almost complete for

various fruit and nut crops, as avocados, walnuts, pecans and hickory nuts, that are propagated as clons. All the members of each clon have the same sequence of dichogamy and when they are planted in solid blocks there is consequently reduction in pollination and in the production of fruit. The remedy is to provide for reciprocation by the proper interplanting of different clons.

In nature, the operation of dichogamy in all its aspects exercises powerful control of pollination and thereby determines parentage in sexual reproduction. It is a potent means of promoting and forcing cross-pollination within species and hybridization between species. It exists widely in all types of flowering plants and it is also known in the lower forms of plant life and in certain of the animals. A. B. S.

DICHRÖITE, a mineral, also called *iolite*, *cordierite* and *water sapphire*. It is named *dichroite* because it shows dichroism, being blue by transmitted light in one direction, and yellowish at right angles thereto. It is transparent to translucent. *IOHITE*, its proper name, is a hydrous silicate of magnesium, iron and aluminium, crystallizing in the ORTHORHOMBIC SYSTEM. It occurs in granite, gneiss and various schists. A transparent gem variety, *water sapphire*, comes from Ceylon. *Iolite* is found in gneisses and granites in New England. See also GEM STONES; PLEOCHROISM.

DICHROMATES. See CHROMATES AND DICHROMATES.

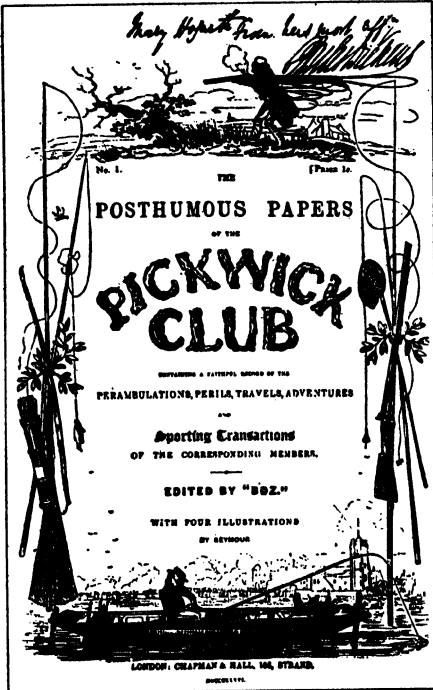
DICKCISSEL (*Spiza americana*), a small migratory bird nesting chiefly in the central United States and wintering in Central and South America, called also black-throated bunting. It is about the size of an English sparrow with handsome yellow, gray, brown and white plumage marked with black on the throat. The dickcissel nests on the ground or in low bushes laying four or five pale blue eggs. In summer it inhabits fields and pastures where, perched on a fence or weed stalk, it constantly utters its peculiar but unmusical song.

DICKENS, CHARLES (1812-70), English novelist, was born at Portsea, Feb. 7, 1812, the second of eight children of John Dickens, a Government clerk, and Elizabeth (Barrow), daughter of a naval officer. He was a sickly boy, fond of reading and of the theater. At an early age he moved to London with his family. He had little formal schooling, and was more or less neglected. His father, some of whose characteristics are preserved in Micawber, was affectionate but improvident; arrested for debt, he was confined in the Marshalsea Prison, where for a time his family joined him. Charles worked in a blacking warehouse, keenly sensitive to the drudgery, and suffering acutely from the degradation; but in these childhood experiences he found many of the characters of his later novels. When, owing to a legacy and a pension, the family fortunes improved, Charles was sent to school. He gained in health, and his exuberant nature asserted itself. He began to write in the spare moments of a clerkship in Lincoln's Inn

and Gray's Inn, reading in the British Museum and studying shorthand. Though he had considered acting as a profession he became a reporter, and contributed various articles to periodicals, his first appearing in the *Monthly Magazine*, Dec. 1833. Others followed, his pseudonym "Boz" being first used in Aug. 1834. A collection of papers, *Sketches by Boz*, was published in 1835-36. On Apr. 2, 1836, Dickens married Catherine, eldest daughter of George Hogarth, a colleague on the *Morning Chronicle*; this same year he began the PICKWICK PAPERS, to accom-

friendship with John Forster, his biographer, dates from 1837. His renown quickly spread to the United States, and in 1842 he made his first visit to America, bringing out *American Notes* on his return. *A Christmas Carol*, 1843, *The Chimes*, 1844, and *THE CRICKET ON THE HEARTH*, 1845, are his best known Christmas stories. *Martin Chuzzlewit* appeared in 1844. In 1846 Dickens spent a year in Italy and Switzerland, which yielded *Pictures from Italy*, 1846; at this time he began *DOMBEY AND SON*, published in 1848. On his return to England, he brought out *DAVID COPPERFIELD*, published in book form in 1850. In 1849 he became editor of *Household Words*, to which periodical he also contributed, and 10 years later editor of its successor, *All the Year Round*. *BLEAK HOUSE* appeared in 1853; *A Child's History of England* in 1854; *Hard Times* the same year, and *LITTLE DORRIT* in 1857. *A Tale of Two Cities*, his only historical novel, except for *Barnaby Rudge*, came out in 1859; *Great Expectations* in 1861; *Our Mutual Friend* in 1865, and *Edwin Drood*, an unfinished novel, in 1870. Dickens wrote many shorter pieces, some of which appeared in *Household Words* and *All the Year Round*. The first collected edition of his works dates from 1847; others appeared in 1852, 1861 and 1874.

Dickens was fond of amateur acting; he revived old masterpieces of the English drama, and wrote several plays himself. He earned large sums by his novels and by the public readings from his works, which he began in 1858 and kept up to the end of his life. In 1856 he bought GAD'S HILL PLACE, near Rochester, which was his home until his death. In 1858



COVER OF THE ORIGINAL EDITION OF "PICKWICK PAPERS,"
AUTOGRAPHED BY DICKENS

pany sketches by Seymour. After the suicide of the artist, the series of illustrations was continued by H. K. BROWNE, better known as "Phiz." Pictures and letterpress were immediately successful; they ran from Apr. 1836 to Nov. 1837. *OLIVER TWIST*, first published in *Bentley's Miscellany*, followed in 1838; *NICHOLAS NICKLEBY*, appearing first, like most of his novels, in monthly numbers, came out in book form in 1839; *Master Humphrey's Clock*, which included *Old Curiosity Shop* and *Barnaby Rudge*, appeared in 88 weekly numbers, from Apr. 4, 1840 to Nov. 27, 1841.

Dickens's growing fame brought him into contact with most of the literary figures of the day; his



CHARLES DICKENS'S HOME, GAD'S HILL, ENGLAND

he separated from his wife; their eldest son lived with his mother, but the other children, of whom at this time there were nine in all, stayed with him. In Feb. 1865 Dickens had a severe illness, and in June of that year was in a bad railway accident, from which his nerves never entirely recovered. From Nov. 1867 to May 1868 he visited America a second time, giving a series of readings which were financially very successful and which were enthusiastically received. He gave more readings on his return to

England, but overwork and excitement hastened the end, which came suddenly at his Gadshill home, June 9, 1870. Dickens is buried in Westminster Abbey.

Generous, sincere and kindly, Dickens was the most widely read novelist of his time; and while his faults are obvious, his popularity continues. The observer rather than the thinker, his sympathy with the common people is profound, though it often leads him to mar his work with "propaganda"; his philanthropy and his moral aim tend to make him paint humanity in black or white. His satire is not always good-natured, but his fun is frequently irresistible. His characters, many of whom approach the Jonsonian "humor," are vital, despite the exaggerations. Dickens's sentiment is at times mawkish, but his writing is vivid, and no writer has created so many characters who are so widely known. *See also ENGLISH LITERATURE.* R. W.

BIBLIOGRAPHY.—John Forster, *Life of Charles Dickens*, 1872-74, new ed. 1928; Mary Dickens, *Letters of Charles Dickens*, 1898; H. F. Dickens, *Memoirs of My Father*, 1929; E. C. Wagenknecht, *The Man Charles Dickens*, 1929.

DICKINSON, ANNA ELIZABETH (1842-1932), American orator and reformer, was born at Philadelphia, Pa., Oct. 28, 1842. She began public speaking at an early age, advocating greater freedom for women and speaking against slavery. During the Civil War she was active in support of the Union. For many years thereafter she continued to write and lecture. She was the author of a number of books and plays, including *An American Girl*, in which Fanny Davenport starred. In 1876 she appeared in one of her own plays, *A Crown of Thorns*, and later in Shakespearean productions. She died at Goshen, N. Y., on Oct. 22, 1932.

DICKINSON, EMILY (1830-86), American poet, was born at Amherst, Mass., Dec. 10, 1830, of a family long prominent in the community. She attended the public school in Amherst and except for a marked precocity in intellect, lived the normal life of a New England girl. In 1847 she was sent to the Mt. Holyoke Seminary to complete her education, but was too cramped intellectually there to be happy, and in 1848 returned to the Amherst Academy. Here she became the "wit of the school," edited the comic column of the school paper and enjoyed the social life of the town. In 1853 she spent a winter in Washington where her father was in Congress. She returned to Amherst and, though she remained a delightful companion to the members of her family, became a recluse. Her poems, among the most exquisite in form and content yet produced in America, she wrote in secret; for the most part they remained unpublished until after her death. The poet's work was published completely in one volume for the first time in 1924. She died at Amherst, May 16, 1886.

DICKINSON, JOHN (1732-1808), American statesman, was born in Talbot Co., Md., Nov. 8, 1732. He studied law, was elected to the Stamp Act Congress and the Continental Congress of 1774, and wrote notable pamphlets, including the first *Petition to the King*. Though he opposed the Declaration of Inde-

pendence, he served in the Revolution, afterward represented Delaware in Congress, and was president of the state. He helped frame the Federal Constitution, and wrote the *Fabius Letters*. He died at Wilmington, Del., Feb. 14, 1808.

DICKINSON, PRESTON (1891-1930), American painter, was born at New York City in 1891. He studied at the Art Students' League, and from 1910 to 1915 worked in Paris. His early interest in the decorative arrangements of the Japanese print-makers prepared the way for the intelligent acceptance of formal elements of structural organization which he found in the art of CÉZANNE. After his return from Europe in 1915 these two influences predominated in his work and are clearly evident in his brilliant still-lives and landscapes.

Subject-matter does not play an important part in Dickinson's art. Although based on recognizable natural forms, his painting is essentially abstract in character, with highly selective, precise arrangements of form and color. Because of his almost exclusive preoccupation with the aesthetic side of art, his work often discloses a certain lack of emotional depth; but his reputation rests fundamentally upon attainments of a high special order—a sensitive intellectuality and a fastidious taste.

In 1926 he was awarded a bronze medal at the Sesqui-Centennial Exposition at Philadelphia. Among his important paintings are *Industry*, *Still Life with Palm*, *Bread and Fruit*, Whitney Museum of American Art, New York; and *Still Life with Plums*, Museum of Modern Art, New York. Dickinson died at Hendaye, France, in 1930. H. M.

DICKINSON, a city in southwestern North Dakota, the county seat of Stark Co., situated on the Heart River, 116 mi. west of Bismarck. It is served by the Northern Pacific Railroad. The city is a shipping center for farm crops and live stock, and has brickworks and railroad shops. A State Normal School is here. Pop. 1920, 4,122; 1930, 5,025.

DICKINSON COLLEGE, Carlisle, Pa., chartered in 1783 and opened in 1784, was the second college founded in the state. It is coeducational and non-sectarian, though under the auspices of the Methodist Episcopal Church. The productive funds in 1931 totaled \$987,500. The James W. Bosler Memorial Library contains 50,000 volumes. In 1931-32 there were 556 students and a faculty of 38, headed by Pres. Karl T. Waugh.

DICKSON CITY, a borough of Lackawanna Co., northeast Pennsylvania, about 4 mi. north of Scranton on the Lackawanna River; it is served by the Delaware and Hudson, Lackawanna and the Ontario and Western railways, bus lines and a nearby airport. There are coal mines nearby. In 1929 its manufactures, chiefly stoves, steel work and silk, were valued approximately at \$1,000,000. Dickson City was founded by Charles Dickson and incorporated about 1840. Pop. 1920, 11,049; 1930, 12,395; about 5% foreign-born.

DICK TEST in Scarlet Fever. *See* SCARLET FEVER.

DICK WHITTINGTON, the hero of an old English legend. A poor orphan, Dick becomes fabulously wealthy by selling a common cat to the miceridden King of Morocco, marries the daughter of his former master, and finally is made Lord Mayor of London.

DICOTYLEDONS, a large class of flowering plants and one of the two main divisions of the **ANGIOSPERMS**. They are characterized by having netted, veined leaves, which germinate with two seed-leaves, and by having the parts of their flowers in fours or fives or multiples of these. Comprising over 200 families of plants, the dicotyledons are the most important group of flowering plants in existence, although they are of comparatively modern origin. See **MONOCOTYLEDONS**.

DICTATING MACHINES, machines used in office work to replace the stenographer in taking dictation. They comprise a cylinder-type phonograph with a recording device. The sound of the voice of a person speaking into the mouthpiece of the machine operates a diaphragm on which a stylus is fixed. This stylus, in turn, engraves a small rotating wax cylinder. The cylinder is then placed on a transcribing machine which reproduces the words for a typist.

DICTATOR, the absolute ruler of the ancient Roman state, always by custom an ex-consul, appointed by the consuls with the approval of the senate in times of great peril to the state, for a period of six months. The other officers of the state usually continued in their duties, subject to his supervision and check. After 300 B.C. the decisions of the dictator could be appealed; with that went the real usefulness of the office.

DICTATORSHIPS, a form of governmental organization in which the ruler possesses unlimited powers of government. During at least one era of Roman history dictators were frequently appointed in times of stress and danger for periods of six months. In modern times the term is often applied to a ruler exercising extraordinary and usually unconstitutional power. Thus dictatorships are said to exist, or to have existed, in postwar Europe in Albania, Hungary, Italy, Lithuania, Poland, Portugal, Spain, Russia and Yugoslavia. That the emphasis in the modern usage of the word is upon the exercise of extraordinary and uncontrolled power rather than upon its concentration in a single person is indicated by the application of the term to the situation in Russia where a "dictatorship of the proletariat" is said to rule. Dictatorships have usually been temporary expedients resorted to in times of emergency as a way out of an intolerable situation, except perhaps in the case of certain South and Central American countries where this form of government has had periods of long duration.

S. C. W.

DICTATUS PAPEAE, a brief document of uncertain authorship found in the register of the letters of Pope Gregory VII. (See **GREGORY**.) It was probably drawn up soon after his accession. Among the propositions it lays down are: The pope alone is properly

called universal; no council or synod may be regarded as a general one without his consent; he may annul all decrees, but no one may annul a papal decree; no earthly power may judge him; no one may condemn one who appeals to the papal see; he may depose emperors; he may absolve the subjects of the unjust from their allegiance; he who does not agree with the Roman Church may not be considered Catholic; the Roman Church has never erred, nor will it ever err. The document appears never to have been officially promulgated, but it summarizes Gregory's ideas of the nature and powers of the papacy. His whole policy was consistent with the principles here enunciated. A thorough application of these policies would have left no room for the development of national churches and little opportunity for secular nationalism.

DICTIONARY, originally, and still most commonly (unless specifically stated otherwise), a compilation of words of a given language alphabetically arranged, explained and defined in the same or in a foreign language, the more elaborate types providing additional information on orthography, pronunciation, derivation, synonyms, correct usage and quotations. With the advance of knowledge, the scope of the dictionary grew, and soon special works appeared pertaining only to a given field, e.g., botany, bibliography, geography, history, medicine, music, philosophy, zoology, etc. Kindred terms are **Lexicon**, explaining words and terms especially of a foreign language or particular author; **Thesaurus**, giving titles, names of authors, full citations and sometimes dates of publications of poetry or of scientific treatises of a given language and period; **Vocabulary**, a collection of words of a foreign language; and **Glossary**, explaining obscure or foreign words of a book. The earliest examples are Accado-Sumerian (see **ACCADIAN**; **SUMERIAN**) word-lists from the 7th century B.C.; the Greeks of the Alexandrine period composed dictionaries and lexicons, and were here followed by the Romans, and a rich literature of this type was developed in **SANSKRIT**.

I. M.

DICTOGRAPH. See **DICTATING MACHINES**.

DICTOPHONE. See **DICTATING MACHINES**.

DIDEROT, DENIS (1713-84), French encyclopedist and man of letters, was born at Langres, Oct. 5, 1713, son of a workman. After studying philosophy, mathematics and physics, he wrote for his living. His writings cover every sphere of intellectual activity. His bourgeois dramas had a new form, away from the classic and influenced Lessing's dramatic theories and the modern drama generally. In 1751 appeared the first volume of his *Encyclopédie*, the stupendous undertaking of his life, to which he devoted some 20 years of untiring labor. After much interference from the government and the church D'Alembert and other co-editors withdrew, and the work was suppressed in 1759. Diderot secretly went on with his task until it was finished, only to have it mutilated finally by his publisher. Through his *Encyclopédie* and his philosophic writings Diderot became the leader of French thought and he is called

the true precursor of the Revolution, in the political, philosophical and literary sense. He died in Paris, July 30, 1784. *See also* ENCYCLOPEDIA; ENCYCLOPÉDISTES; FRENCH LITERATURE.

DIDO or **ELISSA**, in mythology, was daughter of BELUS, King of Tyre, and sister of PYGMALION. She married Acerbus or Sichaeus who was killed by Pygmalion. Dido, taking her husband's wealth, fled to Cyprus and then to Africa. Here she bought land from Iarbus, King of Libya, and founded the city of Carthage. Iarbus pursued her in marriage and threatened war if she did not agree. In desperation Dido stabbed herself. The story told by Virgil that Dido killed herself for love of AENEAS was impossible, since the fall of Troy occurred 300 years before the founding of Carthage.

DIDYMIUM. *See* NEODYMIUM.

DIE CASTING, the process of producing castings by forcing molten metal into a closed metal die or mould. It is usually done by a machine which automatically opens the die and ejects the castings. The process may be rapidly repeated and a large volume of production attained. Die castings have the advantage of being accurate enough so that no machining is required. The process finds its widest application in alloys having a low melting point, as those of zinc, tin and lead, and more recently, brass and bronze.

DIEDERICH, WILHELM HUNT (1884-), American sculptor, was born in Hungary, May 3, 1884, but came to America in boyhood. He studied at the Pennsylvania Academy of Fine Arts, then traveled and studied abroad for 10 years. His *Greyhounds*, exhibited at the Autumn Salon in 1913, attracted attention. In addition to his sculptures, he has designed many artistic objects, such as pottery, candlesticks, tables, brackets and screens. In 1927 a Diederich pottery was awarded a gold medal by the Architectural League.

DIEGUEÑO, a name given by the Spaniards to the Yuman-speaking Indians living in the vicinity of San Diego, Calif. It included various tribes and though without ethnic significance it has long been used and known to refer to these tribes. Several hundred Diegueño are now coordinated with the Mission Indians in California and live with them.

DIELECTRIC, an insulating medium through which electrostatic forces act. The intensity of an electrostatic field near a charged CONDUCTOR depends on several factors, among which is the nature of the insulating medium surrounding it. The force with which one electrostatic charge attracts another nearby charge also depends on the nature of the medium which separates them. The plates of a CONDENSER must be separated by a dielectric, and the CAPACITY of a condenser is determined by the nature of the dielectric, other factors being constant. The dielectric constant of an insulating material is defined as the ratio of the capacity of a condenser with such material between its plates to the capacity of a similar condenser with air as its dielectric.

A dielectric in a condenser must have a relatively high dielectric constant, and, if subjected to high potentials, it must also have high dielectric strength, i.e., ability to withstand high potentials without mechanical breakdown. Glass and mica are especially well adapted, having dielectric constants ranging from about 3 to 9 and 2.5 to 6.5, respectively, and dielectric strengths, in thousands of volts per cm., ranging from about 300 to 1,500 and 300 to 2,200, respectively. Certain liquids are also used as dielectrics. Linseed oil and castor oil have dielectric constants comparable with those of glass and mica, and they have dielectric strengths of the order of hundreds of thousands of volts per cm.

L. B. S.

DIEPPE, a port located in the north of France, on the English Channel, department of Seine-Inférieure. It is a well-known commercial center and watering place. Historically important as a base of trade and exploration, Dieppe suffered greatly from the Revocation of the Edict of Nantes in 1685. In the 19th century its prosperity returned through its popularity as a seaside resort and its activity as a port of cross-channel travel. A British base was located here during the World War. Pop. 1931, 25,117.

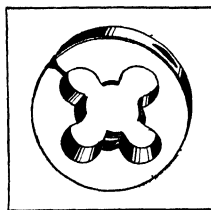
DIES, a general name given to a number of different types of hand and machine tools used for a variety of cutting and forming operations. Dies may be classified in general as threading dies, which are used for cutting threads on bolts, pipes and similar work, and punching and forming dies, used for cutting and forming sheet or solid metal in various ways. Sheet metal, being easily cut and formed, is extensively worked with dies.

Light bar stock is also usually formed into various articles by dies, the operation being done without heating the metal. Heavy stock is sometimes formed cold, but is more often worked hot, thereby reducing the pressure required, making possible the use of lighter dies, and setting up no "cold working" strains. Dies are also used in forming such plastic materials as BAKELITE. *See also* PLASTICS.

Punching and forming dies comprise two parts, one being the mate of the other. The lower part is usually fixed, the piece to be worked being placed in position upon it; the upper part applies the pressure, being attached to the plunger of a press. *See also* DIE CASTING; TAPS AND DIES.

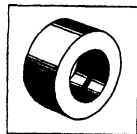
F. H. C.

DIESEL, RUDOLF (1858-1913), German inventor, was born in Paris in 1858. He studied in Munich, and became manager of a refrigerating company in Paris. In 1893 he published a monograph, *Theory and Construction of a National Heat Motor*,



COURTESY PRATT & WHITNEY CO

THREAD CUTTING DIE



RIVET PUNCH DIE

an exposition of his new theory of applying directly the energy created by combustion of fuel. After experimentation for some time with the cooperation of Krupps at Essen, and other factory owners, he succeeded in developing a workable combustion engine (1897). Diesel delivered a series of lectures in the United States 1912-13. On Sept. 30, 1913, while crossing the Channel from Harwich to Antwerp he was drowned. Diesel's whole life was devoted to the improvement of his invention and the development of its uses.

DIESEL-ELECTRIC PLANT, a POWER PLANT in which electricity is generated by dynamos driven by DIESEL ENGINES. These plants are used chiefly in locomotion, boats and industrial establishments, few being used as central power stations. The electric generators of these plants are mainly of the 60-cycle, alternating current type and they require an engine speed such that the revolutions per minute times the

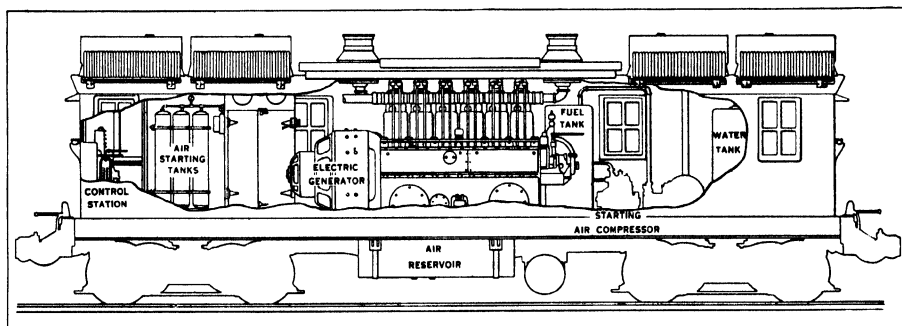
crators, running at 600 revolutions per minute, are mounted on a single chassis, a typical unit being shown in the illustration.

At present one locomotive of this type is in use on the main line of the Canadian Northern Railroad, and two on the Putnam division of the New York Central Railroad. Several are in regular main-line service in Germany and the U.S.S.R. Their use is, however, extending rapidly, though they have the disadvantage that the draw-bar pull decreases rapidly as speed is increased. As at present developed, this tends to keep them off long runs, but in switching service their ability to start a heavy load, which they cannot bring up to a high speed, acts rather as an advantage.

L. H. Mo.

BIBLIOGRAPHY.—L. H. Morrison, *American Diesel Engines*, 1931.

DIES IRAE or Day of Wrath, a Latin hymn on the Last Judgment, believed to have been composed



COURTESY MCGRAW-HILL BOOK CO.

DIESEL-ELECTRIC LOCOMOTIVE, CUT-AWAY VIEW SHOWING INTERIOR AND ARRANGEMENT OF UNITS

number of poles in the generator is equal to 7,200. Consequently, a 32-pole generator must run at 225 r.p.m., a 24-pole machine at 300 r.p.m. These engine-generator units are built in capacities from 3 kilowatts to 12,000 kilowatts, and the fuel consumption of the smallest is equally as good as that of the largest, being approximately $1/11$ gallon of fuel oil per kilowatt-hour generated.

L. H. Mo.

DIESEL ENGINE. See OIL ENGINES.

DIESEL LOCOMOTIVE, a locomotive in which an OIL ENGINE provides the primary source of power. The engine may be connected through a gear-transmission to the driving axles; it may drive an electric generator which in turn supplies current to motors mounted on the driving axles; or it may drive an air compressor supplying air under pressure to cylinders mounted on the frame and connected to the driving wheels by the usual pistons and connecting rods. This last type is, in effect, a LOCOMOTIVE operating on compressed air instead of steam.

The Diesel-electric drive has the advantage of developing a greater draw-bar pull upon starting. Usually one or two 300 horse power engines and gen-

by Thomas of Celano (d. 1255). It is used by the Catholic Church in the Mass for the Dead and on All Souls' Day. Sir Walter Scott has used the opening three lines of the hymn in his *Lay of the Last Minstrel*.

DIESIS, in music, like the COMMA, is a small interval derived by mathematical computation in the system of tuning called JUST INTONATION. In the Pythagorean system of tuning it was the difference between the sum of two major tones ($\frac{9}{8} \times \frac{9}{8}$) and the interval

of the perfect Fourth ($\frac{4}{3}$), which is expressed by the

ratio $\frac{256}{243}$ since $\frac{4}{3} \div \frac{81}{64} = \frac{256}{243}$. Inasmuch as the Pythagorean third ($\frac{81}{64}$) was the sum of these two major

tones, this early definition of the diesis was equivalent to what is now termed a semitone; that is, it was the interval from E to F. Later, when the Pythagorean third was made smaller, the diesis in question was called a limma.

In modern usage the diesis, also called the enharmonic diesis, is the difference between the sum of three major thirds and one octave, expressed by the ratio $\frac{128}{125}$. For example, starting on C, and proceeding upward by three thirds (C—E, E—G#, G#—B#), B# is reached, represented by the ratio $\frac{125}{64}$ (since $\frac{5}{4} \times \frac{5}{4} \times \frac{5}{4} = \frac{125}{64}$). On the other hand, the octave above the original C would be expressed by the ratio $\frac{2}{1}$ or $\frac{128}{64}$. Obviously, therefore, the upper C is actually higher than the B# in question, although they are treated as identical in equal TEMPERAMENT; hence follows the equation, expressing the difference called a diesis, namely, C: B# :: 128: 125. Otherwise expressed, a diesis is equal to the difference between a diatonic semitone ($\frac{16}{15}$) and a chromatic semitone ($\frac{25}{24}$), namely, $\frac{16}{15} \div \frac{25}{24}$, which equals $\frac{384}{375}$ or $\frac{128}{125}$.

DIET, a term sometimes used synonymously with assembly or council. The Imperial Diet of the Holy Roman Empire, the Diet of Worms, and the Diet of the North German Confederation are perhaps the three most renowned bodies to have borne the title.

DIET AND DIETETICS. Dietetics may be defined as the science and art of feeding. Proper feeding in both health and disease depends fundamentally upon the nutritional needs of the individual, which in turn are dependent upon well established physiologic facts or on conditions outside of the body, such as the kind of food available in a community. Heredity and tradition likewise play a rôle.

Uses of Food: (a) *To Supply Energy and* (b) *to Repair Body Waste.* The need of a body for food is dependent upon what the body is doing. The child is a dynamic, growing organism; the adult is more or less static. An individual of a certain build, height, weight, age and occupation is, in general, similar to any other individual with the same qualifications. Long experience and careful physiologic research have established the fact that such an individual in the course of a day will expend a fairly definite amount of energy. Mere existence, which includes the act of breathing, the beating of the heart, the movements of the eyelids, consumes energy. All interchanges of energy in the body are grouped under the general name of *metabolism*, and the energy of mere existence is called *basal metabolism*. (See METABOLISM.)

Now, every body activity consumes energy, and the function of food is to furnish energy to the human machine and also to repair the waste of tissue which goes on during metabolism. All foods, therefore, must perform one or both of these functions.

Classes of Food Elements. The main food elements are grouped under several big headings: (1) *protein*, (2) *fat*, (3) *carbohydrate*, (4) *water*, (5) *mineral salts* and (6) the so-called accessory food factors or *vitamins*. Usually food as eaten is com-

posed of a mixture of these main food elements, frequently with one predominating. A study of food analysis will show, for instance, that beef or the meat of any animal, including fish and poultry, consists mainly of **PROTEINS**, with a varying amount of fat. Protein is the one element of food which contains nitrogen and for that reason is the only food which can replace tissue lost in the body. Many other foods contain small amounts of protein but not in the proportions available in animal matter. (See also **FOOD**.)

The **CARBOHYDRATES** are the starch or sugar parts of food; they are indispensable for rapid use as fuel. They are found in fruits, vegetables, cereals, milk. Ordinary sugar is the most concentrated carbohydrate available, and is found in pure form in fruits, and to a lesser extent in some of the vegetables. Starch is a higher combination of sugars and furnishes the main ingredient of the various cereals and especially bread.

The **fats** are what their name implies: fat of meat, olive oil, butter and the fat portion of cream or milk. Fat furnishes fuel and can also be stored in the body.

The essential nature of *water* as a food element needs no discussion, nor can much be said about the importance of the various *mineral salts*. Table salt (sodium chloride) has always been a necessity of human life, but most foods contain many other kinds of mineral salts, such as iodine, calcium, phosphorus. There is still much to be learned about the salt metabolism of the body, and the proper ratio of salts in the diet.

The "little" food factors, or **VITAMINS**, are occupying the greatest attention to-day. Before the discovery of vitamins, it was known that certain illnesses, such as **SCURVY**, could be cured by the addition to the diet of certain foods, such as fresh milk, fruits or vegetables. Since then, an amazing mass of laboratory work has been done to demonstrate the relation of the so-called vitamins to certain diseases.

Factors Governing Amounts of Food Required. In selecting the diet, attention must be paid to the qualitative ingredients described. The quantitative side of the diet is discussed on the basis of the fuel value of food. The term *calorie* is simply a unit of heat value, which is figured as follows: every gram of protein and carbohydrate yields 4 calories, and every gram of fat yields 9. Water, minerals and vitamins have no fuel (i.e., caloric) value.

In the construction of a diet, many other factors of lesser importance must be considered. The *size*, *age* and *occupation* of the individual are of importance, and the diet depends upon the available sources of the *food supply* in the community. Where foods rich in fat are found, the people eat more fat than those in a community where fat is scarce. On the other hand, fresh fruits and vegetables will be consumed in a temperate or torrid zone where these foods are found in greater abundance than in the more northern climates. Racial habits also are of importance. For instance, the food values of spaghetti and bread are very nearly alike, but certain of the Latin peoples prefer spaghetti to bread. (See also **FOOD**.)

Preparation of Food. The preparation of food cannot be left out of any discussion of proper dietetics. Every food to be consumed must be prepared to suit the taste of the consumer, and in such a way as to be easily digested and properly absorbed by the body. One other factor in dietetics which has received an undue amount of attention is the question of *roughage*. In America, at least, the fad for coarse and rough food has followed the dogmatic statements of advertisers rather than the precepts of scientific knowledge. Generally speaking, roughage takes care of itself whenever a proper supply of food is available.

Fuel Requirements (Calories). The continuance of a healthy life implies proper feeding. In the presence of an adequate food supply, any animal, including man, will choose the foods best suited to his needs. The experience of the human race is, after all, rather immense, and cannot be completely off-set by a few hundred laboratory experiments. The basis of a correct diet must be a combination of experience and experiment. Consciously or unconsciously, attention must be paid to the proper amount of protein, mineral salts, vitamins and fuel.

In building a diet, it is just as well to start with the *fuel requirements* (calories). This can be done in one of two ways, either by the mass method of study or by the individual. The *mass method* is a rather simple one of finding out, by actual figuring of food intake, just what 1,000 soldiers or 1,000 school teachers are eating, and calculating the average from the total. Plenty of statistics are available to give a basis for the fuel value of the average diet for any given group. For instance, it has been demonstrated that tailors use approximately 2,700 calories, whereas woodworkers may use from 5,000 to 6,000 calories a day. A seamstress working by hand will use approximately 2,000 calories and a washerwoman from 2,900 to 3,700. Farmers in various countries have been estimated to use approximately 5,000 calories, whereas lumbermen in Maine use 8,000. These figures, of course, are dependent almost entirely on the nature of the work. The more work, the more energy consumed, and the more fuel needed to supply the energy.

The other method of determining fuel value is by the study of the *individual needs*. This can be done very simply nowadays. Actually, the energy expended, which is called "basal metabolism," can be determined by a simple breathing test. The effects of exercise, labor and of eating are known. Expressed in terms of percentage increase over the basal metabolism, it is a matter of extreme simplicity to find out just how much fuel any given individual of a given age, height, weight, doing a given amount of work, requires to maintain his efficiency. (See also METABOLISM.)

Amounts of Food Elements Required. The fuel value established, it is now necessary to distribute the proper amount of food elements. Regarding *protein*, there has been so much discussion as to the amount necessary, that the only conclusion we can draw is about as follows: the body needs a minimum

of from 1 to 1.5 grams of protein to the kilogram of body weight. Any amount below that, if continued for any length of time, is likely to produce evidence of disease. How much higher the protein intake can be without producing harm, is still a speculative matter. Arctic explorers have lived on a tremendously high protein intake without any apparent damage. On the other hand, it is probably true that some individuals eating protein to excess do suffer certain physical ailments as a result. There is considerable discussion as to the importance of the source of the protein. In general, it is believed that a mixture of the proteins from meat, dairy products and vegetables forms an optimum protein requirement. (See PROTEINS.)

Carbohydrate and *fat* have an equally important value as a supply of fuel, roughly in the relation that one part of fat will supply twice as much fuel as the same amount of carbohydrate. The relative amounts depend essentially upon the source of supply. In the United States, we eat a large amount of carbohydrate, anywhere between 300 and 400 grams per day. That is because carbohydrate foods are cheap and easily available. In Alaska, fuel is supplied mainly by fat. In the United States we use fat mainly to supply calories not furnished by protein and carbohydrates.

Although we do not pay a great deal of conscious attention to the *mineral* metabolism and to the need for *vitamins*, it is a fairly safe statement to make that milk, fresh fruits, fresh vegetables, bread and butter, some meat and an egg or two daily will pretty well cover most of the fundamental nutritional requirements of salts and vitamins. (See VITAMINS.)

The growing child adds the problem of continual change as one of the principles of feeding, but otherwise differs in no way from the adult. Naturally, growth means the need of certain elements which are not required in adult life to as large an extent, such as protein, calcium and iron.

Relation of Diet to Disease. The relation of diet to disease cannot be discussed in detail here. There are diseases in which the body is not able to utilize certain foods, such as diabetes where the sugars and starches are not utilized in a normal way, or scurvy where the lack of vitamin C causes a real disease. There are also probably states of ill health, rather indefinitely associated with certain dietary errors. However, it can be said that, generally speaking, the most important dietetic factors producing ill health may be summed up as follows: (1) insufficient nutrition, (2) overnutrition, (3) unbalanced diet. See also BERIBERI; BIOCHEMISTRY; CALORIES; NUTRITION; PELLAGRA. S.S.

DIETICIAN, an expert on the nutritive values of foods. It is a comparatively new profession. After four years of training at a school of home economics, dieticians most commonly find employment with schools, hospitals, sanitariums, hotels, clubs and sometimes restaurants, where they arrange menus for balanced diets. They also advise on individual diets to comply with the exigencies of health or the dictates

of fashion, as to increase or reduce the weight of the body. See also DIET and DIETETICS.

DIFFERENTIAL CALCULUS, one branch of what at one time was generally called the infinitesimal calculus, a term now tending to go out of use. See CALCULUS and DIFFERENTIATION.

DIFFERENTIAL EQUATIONS, equations involving one or more functions of the variables and their derivatives. The following examples will illustrate some of the simple types of differential equations:

$$(a) \frac{dy}{dx} = \cos x$$

$$(b) xxy \frac{dy}{dx} + x^2 = y^2$$

$$(c) xdx + ydy = 0$$

$$(d) y \frac{\partial z}{\partial x} + x \frac{\partial z}{\partial y} = xy$$

The two main types of such equations are (1) ordinary differential equations, where there is only one independent variable, and (2) partial differential equations, where there are two or more independent variables and their partial derivatives with respect to any of them. The first type is illustrated by (a), (b) and (c) above, and the second type by (d).

Differential equations arise not only in the study of pure mathematics but also in its application to the problems of physics, engineering and science in general. For example, if s is the length of the path of a particle which moves in a straight line for any period of time t , and if v is the velocity and j the acceleration for any time t , then the derivative of s with respect to t represents the velocity, that is $\frac{ds}{dt} = v$. Similarly the rate of change of the velocity with respect to the time t is the acceleration. Hence $\frac{dv}{dt} = j$, or $\frac{d^2s}{dt^2} = j$.

We see that since the terms velocity and acceleration can be expressed in terms of derivatives, many problems in science involving these notions can be stated as differential equations. A very simple illustration of this fact is given by the following problem: If a body falls from rest and at any time t the air resistance is proportional to the square of the velocity, find the velocity. In stating this problem in the language of mathematics we note that the acceleration due to gravity is g acting downward in the positive direction. The air resistance which acts in the opposite direction is proportional to the square of the velocity and may be expressed as $-KV^2$. Hence the acceleration can be expressed as $g - KV^2$. Therefore $\frac{dv}{dt} = g - KV^2$

is the differential equation representing the motion. This differential equation is solved by the methods of INTEGRAL CALCULUS by writing it as $\int dt = \int \frac{dv}{g - KV^2}$. After integrating we have the expression for the velocity, $V = \frac{g}{h} \tanh nt$ where $K = \frac{n^2}{g}$. G. W. M.

BIBLIOGRAPHY.—The following books offer a simple introduction to the subject: Piaggio, *Differential Equations*, 1906; Cohen, *An Elementary Treatise on Differential Equations*, 1907. For a more advanced treatise, consult Forsyth, *Differential Equations*, 1888.

DIFFERENTIAL GEARING is designed to give either variable or fixed relations between the driving and driven members of a mechanism. In MOTOR VEHICLES the differential gearing enables the engine to drive each of the two wheels at a different rate of speed while on a curve. See also GEARS and GEARING.

DIFFERENTIAL GEOMETRY studies those properties of CURVES and SURFACES which relate to small pieces of those geometric entities, or, as it is usually put, pieces in the neighborhood of a given point on the curve or the surface. It deals with such geometric elements as the tangent, the radius of CURVATURE of a curve, the tangent plane, the osculating plane of a surface, and others. The approach is usually through the differential and integral CALCULUS, and books on the calculus deal with differential geometry to a considerable extent. The subject is of great importance in the theory of RELATIVITY.

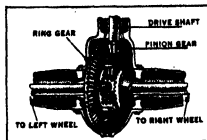
DIFFERENTIAL THERMOMETER, an instrument for detecting differences in temperature. It usually consists of two similar glass bulbs attached to the upper ends of a vertical "U"-shaped glass tube partly filled with a colored liquid. Thus, each half of the instrument acts as an air thermometer. If both bulbs are at the same temperature, the liquid stands at the same level in both vertical arms. If one bulb is heated, the liquid will be depressed in that arm and elevated in the other. See also THERMOMETRY.

DIFFERENTIATION, the process of finding the rate of change of a function $y = f(x)$. If the independent variable x is given a small increment h and if the function is continuous, the change in the function is $f(x+h) - f(x)$, and the limit of the ratio $\frac{f(x+h) - f(x)}{h}$, when h approaches zero as a limit,

is the first derivative of the function, and is symbolized as $\frac{dy}{dx} = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$. Thus if $y = x^n$,

then $\frac{dy}{dx} = nx^{n-1}$. Successive derivatives are obtained in a similar manner. See FUNCTION; VARIABLE; CALCULUS.

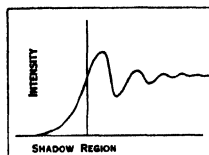
DIFFRACTION, deviation of rays of LIGHT from a straight course when partially cut off by an obstacle or when passing near the edges of an opening or through small holes. A sharp shadow is not formed, but the light bends around the edge into the geometrical shadow. On account of the INTERFERENCE OF LIGHT coming from different portions of the wave front near an edge, the intensity falls off rapidly in the direction of the shadow region from the geometrical shadow; in the direction of the illuminated region, it rises and falls, giving a series of bright and dark fringes of diminishing intensity. The position of these fringes will depend on the WAVE-LENGTH, and



COURTESY STANDARD OIL CO. N. Y.

DIFFERENTIAL GEARING

thus, for white light, the boundary will show prismatic colors. Such diffraction fringes are readily seen upon looking through the eyepiece of a Microscope on which there are dust particles, or upon looking



EFFECT OF INTERFERENCE ON
LIGHT INTENSITY

at a remote bright light through a lens upon which there is a droplet of water.

Diffraction accompanies all forms of wave motion. Its effect, as measured by the extent of bending around an edge, is greater as the wave-length increases. Audible sound waves, which may be several

feet in length, bend around a corner so much that it is difficult to find a sound "shadow." Diffraction is observed readily when a water wave reaches a wall with an opening a few inches wide. The portion of the wave passing through spreads out much as a fan, the amplitude falling off rapidly from the center of the fan.

With light, the phenomenon is best shown by DIFFRACTION GRATINGS, which are pieces of glass on which fine parallel lines are accurately ruled, usually 10,000 to 20,000 per in. If a source of monochromatic light is viewed through the grating, an image of the source will be seen on each side at equal angles from the direction of the source, the angle being larger for longer wave-lengths and closer line spacings. Second and higher order images will also be seen at larger angles. For composite light, spectra of the first and higher orders are formed and afford one of the best methods of spectral studies. The diffraction images and spectra may also be obtained by REFLECTION, many of the best gratings being made by ruling metal surfaces.

P. I. W.

BIBLIOGRAPHY.—R. W. Wood, *Physical Optics*.

DIFFRACTION GRATINGS, a large number of fine, evenly spaced, parallel slits used in studying the DIFFRACTION of light. There are two types, transmission gratings and reflection gratings. In transmission gratings, lines are ruled on glass, the unruled portions acting as slits; in reflection gratings, lines are ruled on a polished metal surface, and incident light is reflected from the unruled portions, thus effecting, by REFLECTION, the same result as is secured by transmission in the other type. Gratings are usually ruled with from 10,000 to 20,000 lines per in. The quality of a grating is determined by its size, the closeness and uniformity of its ruling and the shape of the grooves of which it is constituted.

Diffraction gratings are used in the production of spectra and in the measurement of the wave-lengths of LIGHT. They are much more effective than PRISMS in spreading light over a wide spectrum. With the most powerful gratings, the red and the violet ends of a spectrum would be hundreds of feet apart if cast on a single screen. Gratings are used in almost all precise measurements of wave-length.

If a transmission grating be held before the eye and vision be directed at a linear source of light, e.g., a

single-filament electric light, there will be seen not only the filament but several spectra on each side of it. The blue end of each spectrum will be nearest the central image, the red at the end remote from the central image. As a rule, the first spectrum on each side will be the brightest, the intensity of each succeeding spectrum being progressively less. Each successive spectrum is also wider, beginning with those nearest the center. This width is sufficient so that overlapping of successive spectra begins with the second and third, counting from the center. This overlapping becomes so pronounced in succeeding spectra as to ultimately produce confusion, so that the outermost spectra produced by gratings are not, as a rule, very useful.

The word "diffraction," as used in connection with "grating," indicates a property of light of which the grating takes advantage to so separate and recombine the light waves as to produce spectra. Whenever light emerges from a narrow aperture, it spreads out, much as a dense crowd of people spreads upon emerging from a narrow gate. This spreading, together with the phenomena that attend it, is termed "diffraction" whenever it occurs in connection with light or any other type of wave. Due to this spreading, or diffraction, at a grating, the emerging fan-shaped beams of light overlap. Hence, light reaching any point beyond the grating is made up of beams from all of the slits constituting the grating. The various beams reaching this point have traveled different distances in coming from their respective slits. If the common difference of path between the beams from successive slits is one wave-length of red light, the red end of the first spectrum is produced. Again, reinforcement will occur if the common difference of the path of the light from successive slits is two wave-lengths, or three or, in fact, any integral number. In this way, the various spectra on each side of the center are formed. It will be evident that the more closely the rulings of the grating are spaced, the more widely will the spectra be spread. Hence, most gratings are ruled as finely as possible.

The most useful type of reflection grating is the so-called *concave grating*. This possesses a concave spherical surface. Its utility lies in the fact that it will bring light to a focus, by virtue of its concave surface without the aid of the LENSES which are necessary with gratings whose surfaces are plane.

In modern research, the concave grating has almost entirely displaced the plane grating. It is particularly useful in the production of spectra in the ultra-violet and infra-red, since such light fails to penetrate the glass of which lenses are most commonly made.

L. W. T.

DIFFUSION, that process whereby any substance tends to distribute itself uniformly throughout the whole space within which it is confined. If a small quantity of some strongly colored solution, such as copper sulphate, is placed in a tall vessel and pure water is added without mixing, the solution will at first be divided from the water by a sharply defined surface. If the liquid is allowed to stand for some

time without agitation, the sharp division disappears and the coloration moves slowly upward until the whole body of liquid presents a uniform appearance. Diffusion affords direct evidence of the truth of the two most important postulates of the KINETIC THEORY of matter, viz., that all forms of matter are composed of small particles and that these particles are in motion.

Gases and miscible liquids diffuse into one another to form homogeneous mixtures, gases and liquids diffuse through many solids, and solids may diffuse into one another. Diffusion through a membrane is called osmosis.

Experiments show that the rate at which one substance diffuses into another depends upon the nature of both substances, the temperature and the concentration gradient. This term is defined as the rate of change from point to point of the amount of a substance contained in one cubic centimeter of a mixture.

Substances of low MOLECULAR WEIGHT usually diffuse more rapidly than do those with heavier molecules. Gases diffuse from 10,000 to 100,000 times as fast as do substances in solution. The unequal rates at which gases of different molecular weights diffuse through a porous wall is the basis for a method of separating such gases without chemical action.

A. A. K.

DIGESTION. The foods which we ingest are not, for the most part, in a form suitable for absorption even after they have been thoroughly triturated by the teeth in the process of *mastication*. It is essential that most of the *foodstuffs*, in the form of FATS, CARBOHYDRATES, and PROTEINS (see also BIOCHEMISTRY), be subjected to a treatment which, in principle, changes them from more or less complex chemical substances to relatively simple ones. These changes constitute digestion and are produced easily and rapidly by means of ENZYMES or ferments present in the digestive juices, which are poured into the ALIMENTARY CANAL by the *digestive glands*. The exact chemical nature of the digestive enzymes is not known. Suffice it to say that all are easily destroyed by heat or adverse chemical surroundings, some being inactivated by acid, others by an undue degree of alkalinity. Furthermore, they act in a specific manner, a given enzyme acting only on a class of foodstuffs or even only on a given type of foodstuff belonging to the class. When acting on a food constituent, the changes are effected most rapidly on large quantities of the substance to be acted on at body temperature (98.6° F.), even when the enzyme is added in what would appear to be negligible quantities. Nor does the enzyme seem to be used up in the process. Similar changes can only be effected on similar foodstuffs outside the body by means of violent chemicals, acting in high concentration and at high temperatures over a prolonged period of time.

There are specific enzymes which split each of the food-components: starch, sugar, fat, and protein. Saliva, for example, rapidly converts boiled starches or so-called soluble starches into simple sugars by

virtue of the enzyme, *ptyalin*, which it contains. This action is stopped rather promptly by the hydrochloric acid in our gastric juice. The gastric juice furnished by the stomach, on the other hand, by virtue of the enzyme or ferment, *pepsin*, which it contains attacks proteins such as are contained in meat and brings about their digestion. Pepsin acts in conjunction with hydrochloric acid. Another enzyme, *gastric lipase*, also present in the gastric juice, exerts a feeble action on emulsified fats changing them into fatty acids and glycerine. In the stomach, too, ordinary cane sugar is to a slight extent reduced to simpler sugars by the action of the hydrochloric acid. The major amount of digestion occurs in the small intestine by virtue chiefly of the enzyme content of the juice poured into it by the PANCREAS. The pancreatic juice contains three very powerful enzymes—one for each class of foodstuffs. *Trypsin* rapidly completes the digestion of proteins started in the stomach; *amyllopsin* rapidly reduces the starches to simple absorbable sugars; and *steapsin* vigorously attacks the fats. The rate of action of steapsin is particularly accelerated by the bile coming from the liver and reaching the intestine through a separate duct which empties at or near the point where the pancreas pours out its potent secretion. Bile alone has but feeble digestive properties. The products thus formed by the various digestive enzymes mentioned above are now in a state ready for absorption. In passing through the *mucous membrane* which lines the small intestine, some of these simpler compounds are further attacked by enzymes present in cells through which they pass. Some of the sugars, for example, are rendered even simpler and more useful and some of the fragments of the proteins formed by pepsin and trypsin are further reduced to still simpler chemical states which render them available for immediate use as sources of energy or building materials for the repair of the various organs or tissues of the body. (See also ABSORPTION; METABOLISM.)

A. B. L.

DIGESTIVE SYSTEM. See ALIMENTARY CANAL.

DIGIT, a word derived from the Latin *digitus*, finger, being now used to mean any one of the first nine whole numbers, 1, 2, . . . , 9. Medieval writers spoke of numbers divisible by 10 as articles, such as 10, 20, . . . , 100, 200, . . . , and they called the sum of an article and a digit a composite, as in the case of 11, 28, 104, . . .

DIGITALIS, dried leaves of foxglove. It is one of the most important substances used in medicine to slow and regulate the heart beat, to increase the output of the heart, and thus to improve circulation without affecting the blood vessels directly. It is used in the form of fluid extracts, infusions, and as a special preparation of isolated principles, though its chief form of administration is as *tincture of digitalis*. A patient who is taking digitalis requires close medical observation.

DIJON, an ancient city located in eastern France, once the capital of Burgundy and now the capital of the department of the Côte d'Or. Under the Dukes

of Burgundy Dijon was a cultural center and remained so after the duchy was united with France in 1477. The present day Dijon retains many monuments of its picturesque past. One of the headquarters of the Burgundy wine trade, Dijon is also important commercially for its mustard. Pop. 1931, 90,869.

DIKA NUT, the fruit of a South African tree (*Irvingia Barteri*) of the quassia family used for food by the natives and yielding a solid fixed oil called dika fat or dika oil. The tree producing the dika nut is sometimes called bread tree.

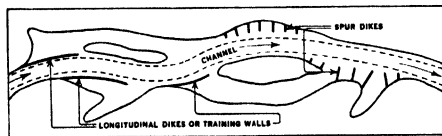
DIKASTERIA, the highest court of appeals in Athens, composed of 6,000 men over 30 years of age, the purpose of which was to check the laws of the assembly and the actions of the magistrates.

DIKE, in geology, a sheet of rock, usually igneous, occupying a fissure, more or less vertical, in older rocks of the earth's surface. As a rule dikes are intruded as molten masses, or magmas, into cracks in the rocks of the earth's crust, coming from larger reservoirs of molten rocks, such as LACCOLITHS, BATHOLITHS or volcanic necks or STOCKS. If inclined less than 45° to the horizontal, they grade into SILLS.

Sedimentary materials can occasionally form "dikes" as when sands fill an open fissure and later become compacted, producing a sandstone dike. The igneous rocks forming dikes are normally fine-grained, as PORPHYRY, FELSITE and BASALT, because quickly chilled by the adjacent cold wall-rocks.

When more resistant than the surrounding rocks, WEATHERING leaves them standing like great walls. If softer they produce long, narrow depressions in the ground. See also IGNEOUS ROCKS; PETROLOGY; VULCANISM.

DIKES, or TRAINING WALLS, works designed to control the flow of water for CHANNEL regulation, shore protection, and the like, are constructed in various forms, including *longitudinal dikes* generally parallel to the stream flow, and *spur dikes* constructed from the shore perpendicular or at an angle to the stream. See GROINS.



APPLICATION OF SPUR AND LONGITUDINAL DIKES FOR CHANNEL REGULATION

Dikes are constructed of: Timber piling, Sheet-piling, Stone-filled Cribwork, Rip-rap, Brush and Stone Mattresses. Those which only partially check the flow of water through them, often serving the desired purpose, are called "permeable" dikes, and generally comprise rows of separated piling, or spaced "clumps" of piling. Trees anchored by the butts to the river bed form a "retard." Dikes should not be confused with *Levees*. See also SHORE PROTECTION; RIVER IMPROVEMENT.

F. R. H.

DILEMMA, a form of argument. Structurally it is a combination of the hypothetical and the disjunctive syllogism. The purpose of the dilemma is to place an opponent in an awkward situation, so that he finds himself caught whichever way he turns. One of the famous dilemmas of history is that used by Caliph Omar in connection with the destruction of the Alexandrian library. He argued that the books in the library must either agree with the Koran or not agree with it; but if they agree with it they are superfluous, if not, they are pernicious; in either case they ought to be destroyed.

The dilemma is a clever form of argument. It may be met by showing that the disjunction is not complete, by showing that one of the conclusions does not follow from the premise or by retorting with a counter-dilemma.

DILL (*Anethum graveolens*), a small herbaceous plant of the PARSLEY family, much grown for its fruits and leaves, which are used for flavoring. It is native to Europe and widely naturalized through cultivation in the United States. Dill is also used medicinally.

DILLARD UNIVERSITY, an institution for Negroes founded in 1932 for the purpose of merging NEW ORLEANS UNIVERSITY and STRAIGHT COLLEGE. The establishment of Dillard was made possible through the financial backing of JOHN D. ROCKEFELLER and JULIUS ROSENWALD.

DILLON, JOHN (1851-1927), Irish member of English Parliament, was born at Dublin in 1851 and educated at the University of Dublin. He soon entered politics, becoming prominent in the "Young Ireland" party, and won a seat in the English Parliament from Tipperary in 1880. He supported Parnell, whom he afterward opposed. One of the most stiff-necked of Irish leaders, his long public career was conspicuous for strife and imprisonment. He became chairman of the Irish National Federation in 1896, and was instrumental in bringing together a convention of the Irish race in the fall of the same year, inviting representatives from all parts of the world. He was Irish leader in Parliament from 1896 to 1898. During the World War, he aided the cause of the Allies and was prominent in Irish recruiting. After the death of Redmond, Dillon was the leader of the Nationalist Party, and was defeated for Parliament in the general election of December 1918. He died in London, Aug. 4, 1927.

DILUVIUM, accumulations of coarse and angular rock-waste, deposited by sudden or violent stream action, together with finer water-worn sediments dropped over the land by a stream in quiet overflow. It is more commonly used in its adjective form, *diluvial*.

This term (Latin for deluge) had formerly a widely different significance. It was introduced into geological literature in the early 18th century to describe heterogeneous continental deposits of coarse detrital material (drift and till, or boulder clay) now universally recognized as of glacial origin, which then

was believed to be referable to the agency of such a catastrophic flood as that described in Genesis. Continental geologists still to some extent employ the word *diluvium* in a revised sense to cover glacial and fluvo-glacial deposits of the Pleistocene ice-age, a meaning now obsolete in England and America. See also ALLUVIUM.

DI MANES. See MANES.

DIME, the smallest silver coin in the United States and in Canada. It is equal to one-tenth of a dollar, or ten cents.

DIMENSIONS. In ALGEBRA the dimension or degree of a term is the sum of the exponents of the letters represented in the term. Thus $3x^2y$ and $7abc$ are terms of the third degree. The term ax^2y is also of the third degree if x, y are considered to be variables, and if a is a constant. In GEOMETRY we say that a line, straight or curved, has only one dimension, length; a surface, plane or curved, has two dimensions, length and width; while a solid has three dimensions, length, width and height, or depth.

In order to measure a length d , an area A , or a volume V , we select a unit of length, say, L , and we have

$$d = n \cdot L, A = n \cdot L^2, V = n \cdot L^3.$$

These relations exhibit the connection between the algebraic and geometric meaning of the term dimension.

In another connection we say that space has three dimensions and the plane has two dimensions, for a point in space has three coordinates, while a point in the plane has two. (See ANALYTIC GEOMETRY.)

It is possible to arrive, at least in a formal way, at the notion of four dimensions if we agree to consider a group of four numbers (x, y, z, u) as the coordinates of a point in a four-dimensional space. The analogy between the formulas for the distance between two points in the plane and in space suggests that the distance between two points $A(x_1, y_1, z_1, u_1)$ and $B(x_2, y_2, z_2, u_2)$ may be defined as $AB^2 = (x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2 + (u_1 - u_2)^2$. We may thus continue to develop an analytic geometry of four dimensions, or of any number of dimensions, in the same way as we develop the two- and three-dimensional analytic geometry. We have no intuitional meaning attached to such a geometry, not any more than we have an intuitional meaning for the term $n \cdot L^4$. But this four-dimensional analytic geometry is nevertheless of great value in theoretical investigations, due to its suggestiveness.

It is generally agreed that the reason why we endow space with three dimensions is experimental in origin. A three-dimensional space, coupled with the notion of time, is sufficient to account for the physical phenomena around us, like size and motion; but this scheme of things has been found inadequate when motion of very high velocity is to be considered. A four-dimensional mixture of space and time seems at present to be a more satisfactory system of reference. This is one of the basic principles of the theory of RELATIVITY. N.A.C.

DIMINISHING RETURNS. It is a fact, known from general experience and from experiment, that on a given quantity of some fixed or constant FACTOR OF PRODUCTION, say LAND, application or input of more than a certain amount of variable factor or factors, say CAPITAL and LABOR, will not yield increase of product, or return, proportionate to the increase of input. This fact, generally recognized as one of the most fundamental laws of economics, is known as the law of diminishing returns, and is a phase of a yet more general law, the law of factorial proportions. The law of diminishing returns was first formulated, somewhat loosely, only for land and for land used only in agriculture. Later it was seen to be true of land in any use. Still later the law was universalized and applied to any factor held constant under variable application of the other factors.

No time element or technological change should be allowed to enter the consideration of diminishing returns in this proper static aspect of the law. In the past there has been much confusion, even among economists, between the static law of factorial proportion and the dynamic or time tendency to what has become known as historical or secular diminishing returns. Changes in the arts over a period of time may counteract the static tendency to diminishing returns or may even make possible for a given outlay increasing returns, that is larger returns for a given input than were previously obtained under an inferior technique. On the other hand, decline in soil fertility and the like may have the opposite effect. These time tendencies, which cannot well be predicted, should not be confused with diminishing returns in the proper sense.

Primarily, diminishing returns should be considered in terms of physical units of input and output. The consideration may also be in terms of monetary expense and monetary value of product. See also MARGINAL UTILITY. A. B. W.

DIMINUTION, in music, the reverse of AUGMENTATION and a department of study in both HARMONY and COUNTERPOINT. Diminution occurs in harmony when any minor or perfect interval is lowered a semitone by raising its lower note, or diminishing the upper note, a half-step. In counterpoint, diminution signifies a decrease in the value of the notes of the melody, whole notes being written as half-tones, quarter-notes or eighth-notes, without altering the succession of the tones. The device is largely used by contrapuntalists as it permits great variation and embellishment of any given theme.

DINAR, a Yugoslavian coin and monetary unit, equal, at par, to about 1.76 cents.

D'INDY. See INDY, PAUL MARIE THÉODORE VINCENT D'.

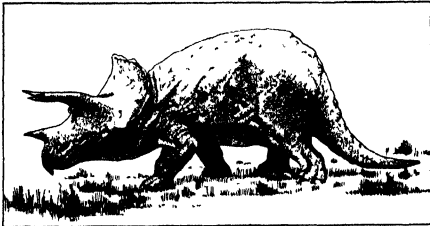
DINGHY. See BOAT.

DINGLEY TARIFF ACT, a bill passed July 24, 1897, notable as a tariff act thoroughly protective in principle but designed especially to produce revenue. Promptly after inauguration, in Mar. 1897, President McKinley called a special session of Congress to enact tariff legislation. The resultant measure, drafted by

the Ways and Means Committee under the chairmanship of Nelson R. Dingley, and modified by the Senate and by joint conference, restored many duties to the level of the McKINLEY TARIFF ACT, but abandoned that act's policy of free raw sugar in favor of a high specific duty for the protection of the sugar beet industry. Reciprocity provisions, absent in the WILSON TARIFF ACT, were again incorporated, but were to be executed by treaties rather than executive proclamations. The amount of protection in most instances was settled upon the representations of the American industries affected.

DINGO (*Canis dingo*), the only large placental mammal in the wild state inhabiting Australia. Naturalists still question whether it is indigenous there or was brought from Asia by the aborigines. It is smaller and stouter than the wolf, with shorter legs. The color varies from sandy to dark brown with intermingling of black. By nature dingoes do not bark, yet learn to do so in association with dogs. At the time of the first European settlements they were abundant; then, because they prey upon sheep, which they mangle or kill in greater numbers than they can eat, war was made on them, until in some parts they are exterminated. On the other hand, their presence is encouraged to keep off grass-eating marsupials. The natives become deeply attached to their tamed dingoes, which make affectionate, loyal companions and excellent hunters of small game. A mixture of dingo blood makes the Australian kelpie the best of cattle dogs.

DINOSAUR, the general name for members of a sub-class or order (Dinosauria) of reptiles, which lived during Mesozoic times, some 14 to 140 million

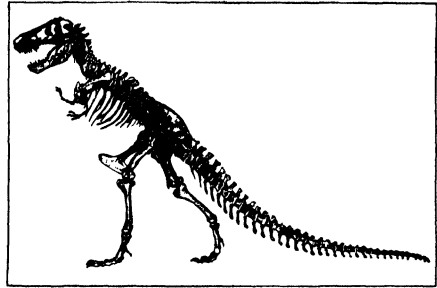


COURTESY AMER. MUS. OF NATL. HISTORY

TRICERATOPS, A HORNED DINOSAUR

years ago. The smallest (*Compsognathus*) is described as having been no larger than a pigeon, while the largest was the most gigantic known terrestrial animal. Even the biggest dinosaurs had tiny brains. They were considerably modified for various modes of living. One (*Brontosaurus*) was a huge quadruped, from 40-70 ft. in length, with a snaky neck and long tail. It fed on vegetables, probably those which grew in marshes and shallow lakes, as it seems to have been semi-aquatic. Another (*Tyrannosaurus rex*) was perhaps the most vicious terrestrial meat-eater that ever lived. This creature walked on its hind legs, holding its ridiculous little fore-legs

after the manner of a kangaroo. It attained a length of 47 ft., and stood some 20 ft. high; its skull was about 4 ft. long; its curved teeth measured from 3 in. to nearly a foot. A third (*Stegosaurus*) was



COURTESY AMER. MUS. NATL. HISTORY

TYRANNOSAURUS REX

Mounted skeleton of a dinosaur of the Cretaceous Period, unearthed in Montana. It is about 47 ft. long and 18 ft. high.

heavily armored with a double row of sharp-edged overlapping plates on its back, and enormous spines on its tail. See also PALEONTOLOGY.

DINOSAUR NATIONAL MONUMENT, created Oct. 4, 1915, comprising 80 acres in north-eastern Utah, contains the most remarkable deposit of dinosaurian and other prehistoric reptilian fossils yet discovered in the world. The largest *Brontosaurus* known to science was taken from this quarry. It is 100 ft. long, 20 ft. high and in life probably weighed 20 tons. It stands in the Hall of Vertebrate Paleontology in Pittsburgh. Many strange and gigantic creatures have been made known through the findings at Dinosaur Monument, and there has been amazingly little duplication. The generally accepted theory in regard to the formation of this quarry is that the animals floated down an ancient river and lodged in a sand bar, where they were eventually covered to a great depth with sand and mud. Millenniums later an upheaval of the earth's crust forced the fossil bed to its present position at the top of Dinosaur Peak.

The Dinosaur Monument is easily reached by automobile. It is 6 mi. from Jensen, Utah, on the Victory Highway between Denver, Colo. and Salt Lake City.

DINWIDDIE, ALBERT BLEDSOE (1871-), American educator, was born at Lexington, Ky., Apr. 3, 1871. He graduated in 1889 at the University of Virginia and studied at Göttingen, Germany, in 1902-03. In 1906 he became associated with Tulane University, where he was made professor of mathematics and astronomy in 1910 and president in 1918. Dinwiddie was a trustee of the Carnegie Foundation for the Advancement of Teaching and active in other educational movements.

DINWIDDIE, ROBERT (1693-1770), British colonial administrator, was born near Glasgow in 1693. He became in 1727 collector of customs for Bermuda and was diligent in correcting abuses in this department. He was made surveyor-general for the

southern American colonies in 1738 and in 1741 became a member of the council of Virginia. Ten years later he was elected lieutenant-governor, and was governor of the colony in 1751-58. In this office, his vision and leadership were guiding factors in the French and Indian war, and he was effective in creating intercolonial amity and cooperation. In 1758 he returned to England. Died in Clifton, July 27, 1770.

DIO CASSIUS COCCEIANUS (c. 150-c. 235 A.D.), Roman historian. A member of the Roman senate, although born at Nicæa in Bithynia, he wrote in Greek a history of Rome in 80 books. The portion of the history which is preserved includes the period from 68 B.C. to 47 A.D. Our loss of the later books is in part compensated by an epitome of them written by Xiphilinus, a Byzantine scholar living in the 11th century. Dio's style is clear, and although his historical method is uncritical, he is an important authority for the closing years of the Republic and the beginning of the Empire.

DIOCESE, in ecclesiastical parlance, the district in which a Bishop exercises his jurisdiction.

DIOCLETIAN (245-313 A.D.), Roman Emperor 284-305, whose full name was Gaius Aurelius Valerius Diocletianus. His reign is chiefly remarkable for the division of the Roman Empire into an eastern and a western half. Selecting an imperial colleague, Maximian, he assigned to him the administration of the west, with Milan as the seat of government. Diocletian himself controlled the east, his capital being Nicomedia in Asia Minor. This division, perhaps necessitated by the unwieldy size of the empire, had momentous results historically. Diocletian and Maximian, themselves enjoying the title of "Augustus," selected younger associates to whom they gave the title of "Caesar," and to whom on their abdication they bequeathed their own title and powers. In this way they inaugurated a new mode of imperial succession. Diocletian abandoning all republican forms, displayed the magnificence of an oriental monarch. The Christians suffered great persecution during his reign.

DIODORUS, a Greek historian, surnamed Siculus, was born at Agyrium in Sicily, and was a contemporary of Julius Caesar and Augustus. From his own work it is known that in early life he traveled extensively through Asia, Africa and Europe, spending a number of years at Rome. At this latter city he gathered much of his materials for his *Bibliotheca Historica*, or *Historical Library*, a general history in 40 books. Three principal sections made up the work. The first section, consisting of six books, dealt with the mythical history of the "barbarians" and Greeks previous to the Trojan War; the second eleven books covered the period from the Trojan War to the death of Alexander the Great; and the remaining 23 books brought the history down to the Gallic Wars of Caesar. The history was written in the annalistic style, which was not adapted to the universal scope of the work, and resulted in a disconnected narrative. Another weakness of Diodorus is his frequent un-

critical acceptance of authorities. Nevertheless, the work is important for its inclusion of materials from ancient writers whose own works have perished. Of the 40 books of the *Bibliotheca*, only books 1-5 and 11-20, besides some scattered fragments, are now extant.

DIOGENES (c. 412-323 B.C.), most celebrated of the Cynic philosophers, was born at Sinope, Asia Minor, about 412 B.C. With his father, who was convicted of debasing the coinage, he was banished from the country and went to Athens. There he was admitted as a disciple of Antisthenes, head of the Cynic school. Diogenes soon adopted his master's teachings, and began to practise an extreme form of asceticism. He renounced as evil all the material and even the intellectual pleasures, and despised the conventions and comforts of civilization. A rough cloak was his only garment; his diet consisted of the simplest food. So anxious was he to divest himself of all superfluities that, upon seeing a boy drink from his cupped hands, he threw away his only wooden bowl. To show his contempt for comfort, he once made his home in a large jar, or tub, in the Metroum. Diogenes was captured by pirates while en route to Aegina, and taken to Crete, where he was sold as a slave to Xenades, a wealthy Corinthian. When asked his trade he replied: "I can best govern men; sell me, therefore, to one who needs a master." Diogenes was taken to Corinth, given his freedom, and engaged by Xenades as tutor to his children. In his meeting with Alexander, the latter bade him ask for any boon, whereupon Diogenes answered, "I ask only that you stand from between me and the sunshine." To this reply, the king is said to have exclaimed, "If I were not Alexander, I should wish to be Diogenes." He died at Corinth in 323 B.C.

DIOGNETUS, EPISTLE TO, professing to have been written by a disciple of the Apostles, a work known for some centuries as one of the most beautiful apologies for Christianity. The author is unknown, but "the most excellent Diognetus" has been identified with the teacher of Marcus Aurelius. The epistle was sent to him in answer to his enquiry regarding the belief of Christians. Its age is the subject of dispute. The Ms. is of the 13th or 14th century and was destroyed in the siege of Strassburg in 1870. The work is not quoted by any ancient or medieval writer. While many believe it to have been written before the age of Constantine, others hold that its origin is 1,000 years later.

DIOMED or **DIOMEDES**, in Greek mythology, son of Tydeus, and King of Argos. He was a famous Greek hero, associated with ODYSSEUS in many exploits. In the expedition against Troy Diomed led 80 ships. He was under the protection of MINERVA who helped him in his contests. From the acropolis at Troy he and Odysseus stole the Palladium, the retention of which was supposed to protect the city from capture. He had wounded APHRODITE during the siege of Troy; in revenge for this Aphrodite influenced his wife to be unfaithful to him during his

absence. Upon his return to Argos he discovered the situation and moved to Aetolia, and later to Apulia where he married the daughter of King Daunus. His death, on the island in the Adriatic named after him Diomedea, was shrouded in mystery. He was worshipped as a hero in Greece and in countries along the Adriatic.

DIONE, in Greek mythology, one of the TITANS, the daughter of OCEANUS and Tethys or of URANUS and GAIA. In early legend she was the wife of ZEUS and was worshiped with him at Dodona where she spoke through an oracle. In later story, when HERA was ZEUS's queen, Dione was looked upon as a nymph. She was the mother of APHRODITE by ZEUS.

DIONYSIUS, bishop of Rome, 259-268. He was elected Pope after the persecutions of Decius and reigned during the period of the local despots, called the Thirty Tyrants, who sprang up in different parts of the Empire, all claiming supreme authority.

DIONYSIUS, the Elder (430-367 B.C.), tyrant of Syracuse. Appointed one of a board of generals at Syracuse, when a Carthaginian invasion of Sicily threatened that city, in 405 B.C. he acquired sole command. After a vain attack upon the Carthaginians encamped before Gela, he retired to Syracuse. Greatly strengthening the defences of Syracuse he successfully withstood a siege by the Carthaginians under Himilco. After the Carthaginians investing Syracuse had been stricken by a pestilence, Dionysius by a sally completed their destruction. In the following years by subjecting many communities in Sicily and southern Italy he widely extended the dominion of Syracuse, thereby thwarting the design of Carthage to control Sicily. Dionysius displayed great interest in philosophy and literature.

DIONYSIUS OF HALICARNASSUS (1st century B.C.), Greek scholar, was born at Halicarnassus, Asia Minor, in the 1st century B.C. He went to Rome about 30 B.C. and there spent years in study, resulting in the preparation of his history of Rome called *Antiquities of Rome*. Written chiefly to reconcile the Greeks to the Roman supremacy, it is a valuable source of information. Dionysius also taught rhetoric. His rhetorical and critical works are generally judged to be in better literary style than his *Antiquities*.

DIONYSIUS THE AREOPAGITE was an Athenian judge, and member of the Areopagus, the famous Athenian court which exercised jurisdiction in cases of life and death and in religious matters. His conversion by St. Paul is related in Acts 17:34, and Eusebius says he became the first bishop of Athens. His name was attached by an unknown writer, since known as the Pseudo-Areopagite, to the mystical treatises on *Celestial Hierarchy*, *Ecclesiastical Hierarchy*, *Concerning the Names of God*, *Mystical Theology*, *Epistles* and a liturgy. These appeared in the 6th century, though probably written a century earlier, and exercised much influence upon medieval thought. The only source of information about the writer is in the writings themselves, which indicate

that he was probably a native of Syria. Abbot Hilduin added additional confusion to the discussion by identifying him with Dionysius or St. Denis, the first bishop of Paris.

DIONYSUS. See BACCHUS.

DIOPHANTINE EQUATIONS, a certain type of indeterminate equations considered extensively by the Greek algebraist Diophantus (c. 275). One of his problems was to find a number which added to two given numbers shall make each sum a square; in our symbols, taking 2 and 3 as the given numbers, to find the value of x which shall make $2 + x$ and $3 + x$ each a square. The term is often applied to indeterminate equations of any kind, but without historic sanction. See INDETERMINATE EQUATIONS.

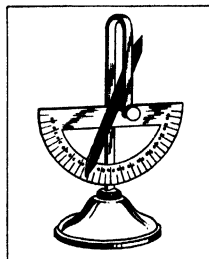
DIOPTR, a unit used in measuring the refractive power of LENSES (see REFRACTION). The power in diopters is the reciprocal of the focal length (see FOCUS) measured in meters. As an example, if the focal length of a positive lens is $\frac{1}{2}$ m., the power is $+2$ diopters. The power, measured in *vertex diopters*, is the reciprocal of the back focal length measured in meters. The *prism diopter* is the unit for the measurement of the prismatic power of an eye-corrective lens. The power of a PRISM which deviates a ray laterally 1 cm. in a distance of 1 m. is one prism diopter.

DIORITE, an IGNEOUS ROCK of coarse to medium texture, speckled black and white because composed of light-colored PLAGIOCLASE feldspars (albite and andesine), and the dark silicates, HORNBLende, BIOTITE and AUGITE. When QUARTZ is present, the rock is called quartz diorite. The fine-grained to glassy equivalent of diorite is ANDESITE. Diorite is widely distributed, and is sometimes used as a building stone. See also PETROLOGY; DACITE.

DIOSCURI or **DIOSCURI**, in classical mythology, the name given to CASTOR and POLLUX, the twin sons of LEDA.

DIP CIRCLE, an instrument for measuring the angle which the lines of force in the earth's magnetic field (see TERRESTRIAL MAGNETISM) make with the horizontal. This angle is called the angle of inclination, inclination or dip, and the dip circle is sometimes called an *inclinator*.

The essential parts of a dip circle consist of a magnetic needle (see MAGNET) mounted on a horizontal axis and swinging in close juxtaposition with a vertical, divided circle. A dip circle is, in effect, a COMPASS turned on edge. The dip needle is mounted on a carefully turned axle which rotates with the needle on carefully prepared agate ways. The smoothness of the axle and of the ways largely determines the sensitivity of the instrument.



COURTESY CENTRAL SCIENTIFIC CO.
A MAGNETIC DIPPING NEEDLE

In the construction of the dip circle, the needle is attached to the axle and balanced as perfectly as possible before being magnetized, accurate balancing being essential. When the mechanical construction has been completed, the needle is magnetized and placed in position on the agate ways. The plane in which the needle swings is set parallel to the magnetic meridian. Readings are taken for both ends of the needle, then the divided circle is reversed and the readings taken again. The needle is then removed and magnetized in the opposite direction, and again four readings are taken, this reversal of magnetization serving to eliminate errors due to inequalities of balancing. From these eight readings the angle of dip is determined.

The angle of dip may be related to the horizontal and vertical components of the earth's magnetic field, this relation being expressed by the formula, $\frac{V}{H} = \tan \theta$, where H is the horizontal and V the vertical component of the earth's magnetic field. See also MAGNETIC DIP. S. R. W.

DIPHENYL, PHENYLBENZENE or BIPHENYL ($C_{12}H_{10}$), a snow-white solid crystallizing in shining plates. It resembles NAPHTHALENE in appearance and somewhat in odor; it has a melting point of 68.8°C . and a boiling point of 255°C . It is prepared commercially by preheating BENZENE to $650^\circ\text{--}700^\circ\text{C}$. and then bubbling it through a molten metal bath held at a temperature of approximately 800°C . Two molecules of benzene unite, splitting off two atoms of hydrogen. The reaction mixture is cooled and crude diphenyl, containing certain higher-boiling products, condenses out.

The principal use for diphenyl, aside from the preparation of its derivatives, is as a heat-transfer medium. It is one of a very few organic compounds which will withstand high temperatures without decomposing, its critical temperature being 980°F . Its particular virtues as an indirect heating medium are that it has a relatively low pressure at temperatures at which steam pressures become excessive, and at such temperatures carries, or can transfer, a greater amount of heat than does superheated steam.

The production of diphenyl on a commercial scale at a reasonable cost was accomplished for the first time in 1928, opening the way to the manufacture of a large number of derivatives of diphenyl which hitherto were practically unknown. The first of these to be marketed were the chlorinated derivatives. These vary in physical characteristics, with increasing chlorine content, from a water-white liquid of low viscosity through a very viscous stage to solid resinous products and crystalline powders. Their use in electrical insulation, varnish and lacquers is being developed. C. H. P.

DIPHENYL OXIDE, a liquid having a pleasing geranium-like odor, used as a perfume and as an ingredient in perfumed soaps. Its formula is $(C_6H_5)_2O$. It was formerly prepared by the reaction of bromobenzene and sodium phenate in the presence of pow-

dered copper, chlorobenzene sometimes being used instead of bromobenzene, but with smaller yields. The newer method of preparation depends upon the reaction of 1-2 gram-molecular weight of aqueous caustic soda and 1 gram-molecular weight of chlorobenzene at a temperature of $350^\circ\text{--}400^\circ\text{C}$. and under pressure in a liquid phase. It is generally purified by distillation or crystallization.

Diphenyl oxide solidifies at ordinary room temperature, having a melting point of 27°C . Its specific gravity is 1.083; boiling point, 259°C . It is very stable, withstanding decomposition at temperatures up to 400°C . It is not very reactive except with reactants capable of replacing the nuclear hydrogen atoms, such as chlorine, bromine, nitric acid and sulphuric acid. It can be hydrolyzed to phenol by an aqueous caustic soda solution at a high temperature. Because of its stability at high temperatures and its suitable thermal properties, diphenyl oxide is being used in power plants as a high temperature heat storage medium.

E. C. BR.

DIPHTHERIA, a specific infectious disease due to the *Bacillus diphtheriae* of Klebs-Loeffler. The bacteria attack the mucous membranes of the throat, except in rare instances, where they affect other mucous membranes (such as the pharyngeal, nasal, and laryngeal membranes) or are found in wounds.

In the throat they set up an inflammation which results in the formation on the surface of a grayish-white patch of material, called a false membrane. This membrane is usually noticed upon examination of the throat. There is usually a certain amount of soreness in the throat, slight fever and marked depression. The general symptoms are produced by a soluble toxin or poison, formed by the diphtheria bacillus and taken up into the blood. The incubation period is from two to seven days.

The infection is usually transmitted from a person suffering from the infection to other persons, or by a healthy "carrier" harboring the bacteria. It may also be transmitted through infected milk or by articles used by the patient.

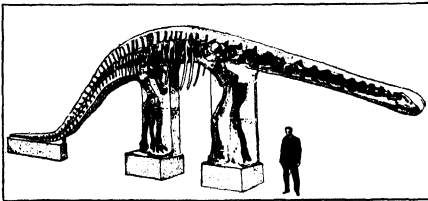
There are complications in other organs, especially in the lungs (bronchopneumonia, which may be fatal), kidneys and heart (see HEART DISEASE). Paralysis of the palate and diaphragm and other forms of neuritis often follow an attack.

Treatment consists in the injection of diphtheria antitoxin (see ANTITOXIN) through the skin. The earlier in the course of the disease the antitoxin is given, the more favorable are the results. If the larynx is obstructed by the membrane, asphyxiation is prevented by inserting a special tube into the larynx through the mouth, or in an emergency, through an opening into the windpipe. Rest also is absolutely essential for the patient, and local treatment of the infected membrane may be helpful.

Children may be protected against diphtheria by injection of a mixture of diphtheria toxin and antitoxin or injection of toxoid. The latter is toxin, specially treated to reduce its toxic affect.

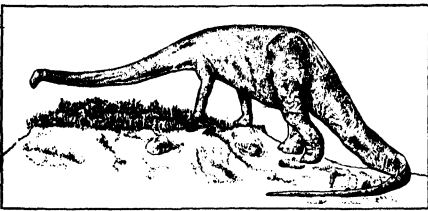
By the use of antitoxin both as a preventive measure and in the treatment, a disease which formerly arose to epidemic proportions has lost its dread and its great mortality among children. *See also* ANTITOXIN; BACTERIA; IMMUNITY; CHILDREN, DISEASES OF; Infectious Diseases.

DIPLODOCUS, a huge wading dinosaur, resembling *BRONTOSAURUS* but longer and more slenderly built. This strangely proportioned reptile was fully 90 ft. long. Its bulky body, borne on four short but massive legs, tapered into an extravagantly long mobile neck ending in a tiny head, and a long thick tail tipped by 10 ft. of whiplash. A mounted skeleton from the Jurassic of Wyoming, in the Carnegie Mu-



COURTESY AMER. MUS. OF NATL. HISTORY
SKELETON OF DIPLODOCUS IN THE MUSEUM AT FRANKFORT,
GERMANY

seum, Pittsburgh, reaches a length of 87 ft., of which some 65 ft. lie beyond the pillar-like leg-supports. The backbone is a fine example of natural engineering, combining strength with lightness. It enabled the lengthy creature, wading shallow estuaries, weighted by the solid leg-bones, to rear aloft at will, balanced on the stout tail. *Diplodocus* was chiefly aquatic in habit, feeding with its weak teeth on succulent water-plants. Fractures in the tail-vertebrae indicate that the whiplash served as an effective weapon.



COURTESY AMER. MUS. OF NATL. HISTORY
MUSEUM MODEL OF DIPLODOCUS

DIPLOMA, an official document or certificate given a student by an educational institution in recognition of satisfactory completion of a prescribed course of study, or a license granted one to practice a profession, as law or medicine. The diplomas given by universities originally were of sheepskin, but are now ordinarily engraved or printed on parchment paper, as are those presented by the elementary or secondary schools.

DIPLOMACY, the art or practice of conducting negotiations, employed in settling differences between states and in securing international redress. Most of

the questions which would otherwise ripen into international conflict are discovered and dealt with through diplomatic officials. Sometimes special representatives or even an international conference, may be called, when ordinary channels fail. Arbitration (*see* ARBITRATION, INTERNATIONAL) is tried in some cases where diplomacy has yielded no result.

DIPLOMAT, a representative of a government whose duty is to negotiate treaties, loans and other matters of international relation with a foreign country. His chief concern is to achieve the business in hand, keeping political amity between the two countries intact. A United States minister, appointed to a country of lesser powers, may act only on the instructions of the President. An ambassador, appointed to a country of higher powers, often acts without waiting for instructions. *See also* DIPLOMACY.

DIPLOPIA, perception of two images of a single object at the same time. If the images of an object perceived by both eyes simultaneously fall upon corresponding parts of the retina, a condition of binocular single vision exists and the object is seen as one object; but if the images fall upon unlike parts of the retina, the object is seen with each eye separately and consequently appears double. This is due to a partial or complete failure of function of one or more of the muscles that move the eyes simultaneously. As a consequence, one of the eyes is not directed exactly toward the object that is being looked at and the image of that object falls upon a different portion of the retina in that eye than in the eye which is directed properly. The failure of muscle function may be due to injury or disease. If the latter, it is most frequently a disease of the central nervous system, affecting the nerve control of the muscle.

In some instances, there is an obstruction in the cornea or lens which interferes with the proper passage of the rays of light and the image of the object is broken within the eye into two separate images. In case these are spaced far enough apart, the individual sees the object doubled. H. S. G.

DIP NEEDLE, a compass used in studying the magnetic field (*see* MAGNETISM) of the earth, or in geophysical exploration (*see* GEOPHYSICS) of deposits which are magnetic, such as *MAGNETITE* or *PYRRHOTITE*. It indicates the inclination of the magnetic field to the horizontal plane or its dip, by means of a magnetic needle which, instead of swinging in the horizontal plane like an ordinary compass, swings up and down about a horizontal axis. *See* DIP CIRCLE.

DIP OF THE HORIZON, the apparent depression of the true horizon caused by the elevation of the observer above sea level or above the level of the land.

DIPPER, a name often given to species of water ouzel (*Cinclus*), slate-colored, wren-like birds frequenting cold rushing mountain streams, because of their habit of diving into the water and running about on the bottom in search of food. *See* WATER OUZEL.

DIPPER DREDGE. *See* DREDGING.

DIPTERA, the scientific name for a very large order of insects, commonly known as flies. It contains some 50,000 species, characterized by having only one pair of wings. Their mouths are adapted for sucking, and sometimes for piercing and they may live on the body juices of other insects, suck the blood of animals and man, or imbibe plant juices. Diptera include both friends and foes of man. Very familiar species are the common house fly, mosquitoes, gnats, midges, crane-flies and fruit-flies.

DIRCE, in Greek mythology, daughter of the sun god Helios and wife of Lycus, King of Thebes. She was tied to the horns of a wild bull by the sons of Antiope (*see* AMPHION), the first wife of Lycus, whom he had divorced, and dragged to death. Dirce's body was thrown into a well which was named after her, the fountain Dirce.

DIRECT ACTION, a phrase applied to the policy, espoused by certain LABOR ORGANIZATIONS and radical groups, of refusal to sanction the intervention of any intermediate agency between them and their employers in their economic struggles. The emancipation of the workers, say the direct actionists, must come through the efforts on the job of the workers themselves. This implies emphasis upon the STRIKE, the BOYCOTT, SABOTAGE, physical force and even violence. It implies, negatively, repudiation of all the devices of political and parliamentary action—voting, lobbying, electioneering, office-holding and law-making. It would seem to imply renunciation of ARBITRATION, of the governmental type at least. Before the World War the American Industrial Workers of the World and the French Syndicalists, the chief groups that have preached direct action, went so far as to repudiate COLLECTIVE BARGAINING and the trade agreements resulting therefrom as obstacles to strike efforts. Yet collective bargaining would seem to be essentially a form of direct action; and now the syndicalists (*see* SYNDICALISM), their syndicalism being much watered down, regularly utilize such bargaining. The I.W.W. continues to deprecate it—at least so far as it commits workers to time agreements. P. F. B.

BIBLIOGRAPHY.—Consult indexes (under *Direct Action*) in P. F. Brissenden, *History of the I. W. W.*, 1919; D. Saposs, *The Labor Movement in Post-War France*, 1931.

DIRECT CURRENT, an electrical current which flows continuously in one direction thus differing from an ALTERNATING CURRENT which flows alternately first in one direction, then in the other. In a direct current circuit, one line is always of positive polarity, the other negative; in an alternating current circuit each line is alternately positive and negative. Early electrical systems were almost entirely direct current and it is only in comparatively recent times that extensive efforts have been made to replace these systems with alternating current. Direct current can not be transformed readily from one voltage to another. It is thus difficult to transmit over long distances without excessive power losses.

DIRECTOIRE STYLE, in architecture and the decorative arts, the style that characterized the period

in France between the fall of Louis XVIth and the dictatorship of Napoleon. A period of great turmoil, it produced little architecture; but the new popular enthusiasms of the Revolution demanded in all the minor arts a complete revolution from the courtly delicacy of the Louis XVIth period. The result shows chiefly the classic enthusiasm of the time, the aim to recapture the elegance, finish, dignity and beauty of Roman art, the art of that classic period which the people considered a veritable golden age. Directoire fashions and decorative work have therefore something of the Roman quality of the following style, that of the Empire, and yet retain much of the lightness of the Louis XVIth.

DIRECTORS, individuals elected by the stockholders of a CORPORATION to direct its affairs. The board of directors is responsible to the stockholders for the proper management and success of a corporate undertaking. Bank directors are also responsible to the national or state banking authorities for observance of the banking laws and for the practice of sound banking principles (*see* BANKS AND BANKING). National bank directors are required to be citizens of the United States and to own at least five shares of stock if the CAPITAL of the bank is \$25,000 and ten shares if the capital exceeds that amount. National banks must have not less than five directors.

DIRECTORY (DIRECTOIRE). *See* FRENCH REVOLUTION.

DIRGE, in music, generally any hymn or choral service sung at a funeral, or upon occasions commemorative of the dead. The dominating spirit of the dirge is melancholy and grave, and funeral in tone, as Chopin's familiar *Marche funèbre* in C minor. The dirge may be described as the musical equivalent of the elegy. It receives its name from the first word of the antiphon, *Dirge, Domine, Deus meus, in conspectu tuo viam meam*, used in the Catholic service for the dead. A dirge is conventionally set to duple or quadruple rhythm, and invariably played slowly.

DISABILITY INSURANCE, protection against financial loss as the result of illness or accident. Prior to the creation of disability insurance, many LIFE INSURANCE policies lapsed because of the inability of the insured to pay PREMIUMS when disabled and, consequently, unproductive. A disability clause may be added to a life policy by payment of a comparatively small additional premium. Such a clause provides for waiver of all premiums upon acceptance by the company of proof of total and permanent disability before the age of 60, and it provides for payment to the insured of a monthly disability ANNUITY of 1% of the amount of the policy. The payments continue as long as the disability lasts or until maturity of the policy, disability being considered permanent if it continues more than 90 days. If the insured recovers payments are discontinued and premiums resumed. Payments during disability are not deductible when the policy matures.

DISARMAMENT, contrasted with limitation of armament (*see* ARMAMENTS LIMITATION), the com-

plete abolition of national defensive establishments. In 1926 the Soviet Government submitted a plan for complete disarmament to be carried out simultaneously by agreement of the "powers." It failed, however, to receive serious consideration. In 1925 and 1930 proposals for the unilateral disarmament of Denmark were brought forward and seriously discussed in the Danish parliament. See *OUTLAWRY OF WAR*.

BIBLIOGRAPHY.—S. Madariaga, *Disarmament*, 1928.

DISARMAMENT CONFERENCES, of which six have taken place since the WORLD WAR, the series of meetings concerned exclusively with problems of the limitations of armaments, and, as such, not to be confused with the parleys, such as that of Locarno, where questions and difficulties of a more general international scope are discussed. The first post-war disarmament conference was the WASHINGTON CONFERENCE, which met in the capital of the United States on Nov. 12, 1921, deliberations lasting until Feb. 6, 1922. Delegates from the United States, Great Britain, France, Italy and Japan attended. A Five-Power Treaty was signed, the main feature of which was the agreement to a reduction to 22 capital ships for Great Britain, to 18 for the United States, and to 10 each for France, Italy and Japan. The second conference was called by the LEAGUE OF NATIONS, and met at Geneva, Switzerland, in May, 1926. It called for a "reduction of armaments to the lowest point consistent with safety," but it was barren of practical results. The third disarmament conference met in June, 1927, again in Geneva, on the invitation of President Coolidge. It was attended by delegates of the United States, Great Britain and Japan, France and Italy sending observers. An agreement on theoretical parity was reached, but a decision concerning practical application of parity was not forthcoming. The fourth conference, called by the United States, met in April, 1929, again in Geneva. During the autumn of the same year the British Prime Minister, Ramsay Macdonald, visited the United States and called on President Hoover, with the result that on Oct. 7 the British Foreign Minister issued invitations for a Five-Power naval parley in London, the fifth disarmament conference. In 1932 a sixth disarmament conference was held in Geneva.

DISCIPLES OF CHRIST, a religious body which originated in southwestern Pennsylvania and the adjacent parts of Ohio and West Virginia, not yet separated from Virginia, early in the 19th century. It is the largest denomination of American origin, in 1930 ranking fifth in size among the Protestant families. Thomas Campbell, a Scotch-Irish Seceder Presbyterian minister who had come to America in 1807, soon became convinced that the divisions existing among Christians were both sinful and unnecessary. He rejected no particular item in the creed of his own Church, but protested against erecting its doctrines and "inferential truths" into criteria of fellowship. He organized those of like mind into The Christian Association of Washington, Pa., whose principles, as well as his own, he expressed in a Declaration and

Address, 1809, in which he declared that "the Church of Christ is essentially, intentionally and constitutionally one," and that actual unity could be regained only by making the terms of admission identical with the conditions of salvation and the structure of the Church identical with that of the primitive churches, as both are expressly revealed in the New Testament. The Christian Association soon organized itself as an independent church. Further study brought the conviction that immersion of believers was the only authorized baptism and that it should be required as a condition of membership. In 1813 this little church of "Reformers" was received into the Redstone Baptist Association.

Meanwhile, Thomas Campbell's son, Alexander (see CAMPBELL, ALEXANDER), had arrived in 1809 from Ireland, via the University of Glasgow, and he soon assumed the leadership of the movement, for the Campbells and their associates continued to be Reformers although they had become Baptists. Their views gained wide currency in the Baptist churches, especially through Alexander Campbell's debates and his magazine, *The Christian Baptist*, and through the preaching of Walter Scott, a young graduate of the University of Edinburgh who developed a highly effective method of presenting the "plan of salvation."

During the years 1827-30 a separation from the Baptists gradually occurred, and the Reformers began their independent existence as Disciples of Christ with about 12,000 members. This number was almost doubled by union, in 1832, with a large part of the Christian Church which, under Barton W. Stone, had arrived at an almost identical position. (The remainder of this Christian Church, increased by the growth of a century, united with the Congregationalists in 1930.) The growth of the Disciples was rapid, especially toward the West. Carefully avoiding any sort of organization with legislative power over the churches, they soon began to form district and state cooperations to support evangelistic work. In 1849 their first national convention met in Cincinnati (annual thereafter), and the American Christian Missionary Society was organized. Many colleges were established, including Bacon, in Kentucky, later merged with Transylvania; Bethany, in West Virginia; Hiram; Butler; Eureka; and Drake.

The total assets of the colleges under their auspices amounted to \$33,000,000 in 1930. The various national missionary and benevolent societies were combined in 1919 to form the United Christian Missionary Society. The annual offerings through this and the state missionary societies and for education had risen to about \$5,000,000 by 1930, besides large gifts to independent agencies. In 1930 the church membership was 1,554,678. W. E. G.

BIBLIOGRAPHY.—E. Gates, *History of the Disciples of Christ*, 1905; M. M. Davis, *How the Disciples Began and Grew*, 1915; A. W. Fortune, *The Origin and Development of the Disciples*, 1924; W. E. Garrison, *Religion Follows the Frontier, a History of the Disciples of Christ*, 1931.

DISCIPLINE. Military or naval discipline is a system of command, instruction and training carried

out in military or naval organizations. Its end is to ensure subordination and efficiency and to develop in the men the virtues of a military character. Discipline is exercised through the officers, both commissioned and noncommissioned, for each carrying out his respective part. The ultimate responsibility, however, rests upon the commander. He must exhibit justice, firmness, activity, calmness, knowledge of his duties, kindness and impartiality.

The disciplined mind and body are as necessary in civil as in military life. In civil life these qualities produce the good citizen, a supporter of law and order. Such a citizen is actively interested in civic affairs to which he contributes a due amount of his time. Civil discipline is produced by education and training in the schools and the home. J. W. W.

DISCIBOLUS, the Discus Thrower, one of the most forceful and famous of ancient Greek statues, produced by the artist Myron in the 5th century B.C. Several copies exist, of which the best is the bronze,



COURTESY F. P. CAPRONI AND BROTHERS

DISCIBOLUS

In the Lancellotti Palace, Rome

retaining the head, which in 1761 was discovered on the Esquiline Hill in Rome, now in the Palazzo Lancellotti, Rome. Others, in marble, are in the Vatican and British museums; they are partial reconstructions.

DISCORD, in music, a term describing an unpleasant effect produced by certain tones when sounded together. It is the same as a dissonance, and the opposite of a consonance or concord. To some extent a discord may be given an objective and scientific definition—i.e., in terms of acoustical phenomena known as beats—but in another sense such a definition is fruitless since a discord for one auditor will be reckoned a concord by another, and *vice versa*. Furthermore, the dissonant quality is to some extent a function of dynamics: a mild dissonance, when played softly, may become a severe dissonance when played vigorously. Strictly speaking, there is but one interval not a discord, namely, the unison; however, even the unison has discordant intervals among its harmonics. According to present-day standards, there are but two discordant intervals, the second (major and minor) and the seventh (major and minor), and any chord comprising either of these intervals is therefore a discord. However, according to the standards of Greek music, only three intervals, the octave, fifth, and fourth, were concords; all other intervals were discords. There has thus been a radical decrease in the number of intervals called discordant, and in general the modern tendency is toward a further decrease.

DISCORDIA, in Roman mythology, the goddess of strife, identified with the Greek Eris. She was

the sister of **MARS**, the god of war. It was **Discordia** who threw the golden apple, the apple of discord, into the wedding feast of **PELEUS** and **THETIS**. The apple was labeled "to the fairest," and for its possession **JUNO**, **VENUS** and **MINERVA** contended. **PARIS** decided in favor of **VENUS**. In return **Venus** helped **Paris** to abduct **HELEN** of **TROY**, thus bringing about the Trojan War. **Discordia** was driven from **Olympus** by **Zeus** because of the trouble she made among the gods and goddesses.

DISCOUNT, the amount of the reduction from a stated or base value or price, as allowed to a customer for prompt payment of his account or to a banker for discounting a **NOTE**. Goods are often sold on optional credit terms such as, 2/10, n/30, which means that a 2% allowance will be made if payment is made within ten days or a maximum credit term of 30 days is permitted. Such a discount is termed a sales discount. Bank discount is the same as **INTEREST**. The discount allowed from a list price is termed **TRADE DISCOUNT**.

DISCOUNT CORPORATIONS, specialized banking concerns whose principal business comprises dealing in **ACCEPTANCES** of banks and bankers (see **BANKS AND BANKING**) and short-term credit obligations of the highest quality, such as United States Treasury certificates of indebtedness, United States Treasury notes and bills and such United States Liberty or Treasury bonds as are approaching maturity. Discount corporations stand ready to purchase bankers acceptances from local banks, agencies of foreign exchange banks, merchants, importers, exporters and investors. The acceptances are purchased either for spot or forward delivery, and importers and exporters are, therefore, enabled to determine accurately the cost of financing transactions which are being undertaken for completion at some future date.

Discount corporations customarily invest much more than their **CAPITAL** in these short-dated securities. The amount invested over and above the capital funds employed is supplied in the form of loans by banks, private bankers and others having temporarily unemployed funds at their disposal. Such loans made to discount corporations may be said to be of the highest grade because the collateral security offered is eligible for sale to the Federal Reserve Bank (see **FEDERAL RESERVE SYSTEM**), which makes the loan highly liquid and is, consequently, preferred by such lenders who must place their surplus reserve funds in such a manner that repayment by the borrower is possible under any circumstances that might possibly arise. In fact, bankers regard loans to discount houses as a primary cash **RESERVE**, and one of the principal functions of a discount corporation is to act as an intermediary between banks in finding outlets for surplus money, either by sales of short-term securities or by absorbing the surplus funds by loans.

The business of discount corporations was made possible by the enactment of the Federal Reserve Act, which permitted American bankers to accept **BILLS OF EXCHANGE**. Such corporations can operate with

the greatest efficiency only in the largest financial centers. They have been in existence in London for many years, there being, in that city, four incorporated companies and seven or eight other firms who do a discount business similar to the incorporated companies. Only one truly discount corporation exists in the United States, that found in New York, but there are other organizations which do a similar business.

DISCRIMINANT, an expression by which it is possible to discriminate as to the nature of the roots of an equation. It is the simplest of the rational integral functions of the coefficients which, on becoming zero, expresses their condition of equal roots. For example, in the general quadratic equation

$$ax^2 + bx + c = 0, x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

and if $b^2 - 4ac = 0$, then the \pm term disappears and the two roots are both equal to $-b/2a$. If this discriminant $b^2 - 4ac$ is positive, the roots are real; if negative, they are imaginary. See EQUATIONS.

DISCUS THROWING, the art of throwing a discus of prescribed weight from a circle. It was an ancient athletic exercise popular among the Greeks and Romans, and was one of the five events of the Pentathlon at the ancient Olympic Games. The sport was revived at the first of the modern OLYMPIC GAMES, held at Athens in 1896.

Excavations indicate that the ancient discus was a stone plate of from 8 to 10 in. in diameter, weighing 4 or 5 lbs. Some of the ancient instruments resemble a quoit, having a central hole through which a leather thong was passed. The modern discus is of wood, with a metal rim, and is convex on both sides. It is not less than $8\frac{1}{8}$ in. in diameter, not less than $1\frac{1}{4}$ in. in thickness through the center and not less than $\frac{1}{2}$ in. at a point $\frac{1}{4}$ in. from the outer edge. The discus is weighted to an exact 4 lbs. $6\frac{1}{10}$ oz., by lead plates in the center, these being covered on both sides by smooth brass plates not more than $2\frac{1}{2}$ in. in diameter or less than 2 in.

The throw is measured from the edge of the circle to the point where the discus first strikes the ground.

DISESTABLISHMENT, commonly an ecclesiastical term, which refers specifically to the disendowment as national churches of the episcopal churches in Great Britain. The first step in Great Britain toward disestablishment was the actual establishment of the Presbyterian Kirk in Scotland, which necessarily involved the defeat of Anglicanism. The disestablishment of the Church in Ireland came in 1869. In England and Wales the agitation even finds support among some Episcopalians, and Acts to disestablish the Church in Wales have been introduced into Parliament on more than one occasion. Because such a complete separation of Church and State usually involves churches which through many centuries have attained great wealth and prestige, their disestablishment is not looked upon with favor by the majority of their members and is further suspected by others to be the thin edge of the wedge to secure semiofficial

or equal official recognition of other forms of religion, and consequently the movement is actively opposed by a large body of English churchmen.

DISHWASHERS. There are both stationary and portable dishwashers, the former being built into a deep sink to form a single compact unit. The usual design comprises a cylindrical container with shelves to hold dishes and silver, and a power-driven propeller for circulating hot, soapy water over and around the articles to be washed. Simplification of filling and draining has done much to make the electric dishwasher popular. Sales figures have mounted slowly, 10,000 being sold in 1928, 12,000 in 1929 and 15,000 in 1930.

DISINFECTANTS. The terms disinfectant, germicide, antiseptic, and bactericide are frequently used interchangeably to denote substances of natural or synthetic origin, organic or inorganic, which kill bacteria or render them innocuous. However, the word "disinfectant" commonly refers to substances used for the sterilization of premises and utensils and the skin and hair of animals. Disinfectants are particularly important in the sterilization of buildings and rooms after they have been occupied by persons afflicted with contagious diseases. PHENOL (carbolic acid) has been widely employed for that purpose; it is, however, more caustic and toxic and less efficient than the CRESOLS and other homologs of phenol, which are present in such disinfectants as lysol and creolin. Up to a certain point, the efficiency of disinfectants increases as the molecular weight increases; xylemol, thymol, carvacrol and similar homologs are particularly efficient.

The disinfection of rooms following disease requires the use of volatile disinfectants. CHLORINE is sometimes used, but is limited in application by its corrosive action. The most commonly employed disinfectant for such purposes is FORMALDEHYDE, which is efficient and readily available. Other products which are being employed to a smaller extent, not only for killing bacteria, but also small animal parasites, are HYDROCYANIC ACID and ETHYLENE. For disinfection of floors, etc., the COAL TAR disinfectants are ordinarily used.

The CRESOLS are usually employed for the so-called animal "dips." Cresol Solution Compound U.S.P. is a 50% emulsion of cresol and soap solution. Domestic animals are dipped in diluted solutions of this product in order to prevent the spread of skin infections and to remove small body vermin. E. H. V.

A solution of one part mercuric chloride or corrosive sublimate in a thousand parts of water is useful for the disinfection of clothing. Lime, either pure, mixed with water, or as CHLORINATED LIME or Dakin's solution, is valuable for the disinfection of excreta, or in weaker solutions for the skin. The stools of typhoid fever patients must always be disinfected, preferably with lime. See also ANTISEPTICS.

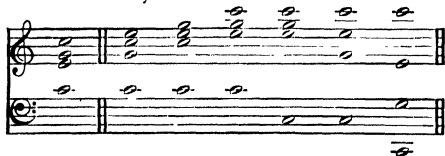
DISMAL SWAMP, GREAT, a large marshland covered with heavy timber and tangled undergrowth interspersed with bands and patches of marsh grass,

situated in southeastern Virginia and northeastern North Carolina. It begins a few miles south of Norfolk, Va., and extends south for over 30 mi. varying between 15 and 25 mi. in width and covering approximately 800 sq. mi. Originally, the swamp covered about 2,200 sq. mi. but it has been extensively drained and reclaimed. A ship canal has been cut through connecting Albemarle Sound and Chesapeake Bay. Near the center of the swamp is Lake Drummond, a shallow expanse 7 mi. long and 5 wide. An ancient sea beach, the Nansemond escarpment, which rises from 5 to 50 ft. in height, forms the western boundary of the swamp.

DISPERSION, in LIGHT, the separation of rays of different colors or WAVE-LENGTHS into a spectrum by the action of a PRISM or LENS, due to the different degrees of refractibility of the rays (see REFRACTION). For a given prism, the angular spread between two rays is determined by the angle of the prism and by the difference of the refractive indexes of the two rays. The dispersion of any given body at any point in the spectrum is defined as the ratio of the angular distance between two neighboring rays to the corresponding difference in wave-length. Normally, the colors are arranged in the order of wave-length, the long waves being deviated from their original direction the least, i.e., the refractive index increases, or the velocity decreases, as the wave-length increases from that of red to violet. For prisms of different materials, even though the length of the spectra be the same and the order of colors normal, the position of a color is different in the various spectra, each prism having its own peculiar dispersion curve. In some substances there is *anomalous dispersion*, in which case some of the colors may be interchanged. P. I. W.

BIBLIOGRAPHY.—R. W. Wood, *Physical Optics*.

DISPERSION, in music, the scattering of the elements of a chord, the structure of which remains the same since the tones are merely placed in different octaves. Any chord may thus yield great variety even while it remains unchanged according to the principles of HARMONY. An illustration of dispersion shows this clearly:



DISPLACEMENT of a vessel is the weight of water she displaces, expressed in tons of 2240 lbs., and is calculated from the ship's lines. The displacement includes the weight of the hull and machinery, and everything aboard. See also NAVAL ARCHITECTURE.

DISRAELI, BENJAMIN (1804-81), Earl of Beaconsfield, English statesman and novelist, born in London, Dec. 21, 1804. His grandfather, Benjamin Israeli, was an Italian Jew who migrated to

England in 1748 and entered trade under the name of D'Israeli. Whether the family was Levantine in origin or, as D'Israeli's grandson preferred to think, descended from exiles driven from Spain and Portugal in the 15th century, is unknown; but, in London, it became related by marriage to famous Portuguese and Spanish Jewish families. Isaac D'Israeli, the son of Benjamin and father of the future Earl of Beaconsfield, was, until 1813, a member of the Portuguese synagogue; but temperamental antipathy for orthodox Judaism and his refusal to accept appointment as an officer of the synagogue led to his withdrawal, and he had his children baptized in the Church of England.

Educated in private schools kept by liberal dissenting ministers, Benjamin Disraeli (he adopted this spelling of the name in 1823) was articled to a solicitor when he was 17, with a view to entering some government office. This suited him not at all, and, in an endeavor to make his mark in another field, he speculated and lost heavily in South American stocks. A pamphlet he had written on South American investments won the attention of the publisher, John Murray, who listened to a plan propounded by Disraeli for founding a new daily paper that would be a rival to the *Times*. The outcome was disastrous; but Disraeli saved something from the wreck by embodying his experiences in melodramatized form, in a novel, *Vivian Grey*, which he published in 1826. That summer he made a trip to Switzerland and Italy. He was entered for the bar, but without any serious purpose to become a lawyer. To obtain the money necessary for further travel he wrote a novel, *The Young Duke*, which he sold in 1830 for £500, and with the proceeds he sailed for Spain and the Levant. This voyage colored his whole career; the Near East was Disraeli's spiritual home, and his Turcophile policy, his belief in Britain's destiny as an oriental power and his contempt for the peoples subject to Turkish rule were all quickened, if not created, by this visit to the lands of his forefathers. One result of his voyage was *Contarini Fleming*, one of the finest of his novels, something of an idealized autobiography setting forth his own nature and ambitions.

In 1832, Disraeli twice stood for Parliament as a Radical, and was twice defeated; in 1834 and in 1835 he stood as a Tory and was defeated; but in 1837, in the elections for Victoria's first parliament, he was successful in contesting Maidstone as a Tory. His maiden speech, on an Irish topic, was an utter failure: his appearance was bizarre, his gestures theatrical, his phraseology over rhetorical; and he sat down in a wave of derisive laughter. "I sit down now, but the time will come when you will hear me," he said.

When Peel formed a Tory ministry in 1841, Disraeli, then a member of Parliament for Shrewsbury, asked for the office and was passed over. He made himself the spokesman for the landed interest in criticising the prime minister's abandoning protection; when it became clear that nothing could stop the repeal of the corn laws, Disraeli had his revenge by

engineering Peel's defeat on the coercion bill for Ireland.

In the Derby-Disraeli ministry of 1852, which held office without a majority in either house, Disraeli was chancellor of the exchequer and the real, though not the nominal, leader of his party. This administration fell before Gladstone's onslaught on Disraeli's budget. The second Derby-Disraeli cabinet, 1858-59, had a brief tenure of little more than a year; their third administration, 1866-68, was notable for the passage of the second parliamentary reform bill; the debates had served to stimulate interest in the question; and Disraeli, ever an opportunist, realized that the country now demanded a widening of the franchise and decided that the Tories might as well give the people what they wanted. In the course of debate the "fancy franchises" introduced to comfort the Tory mind were dropped; and the bill, when it became an act, added over a million voters to the registers—more than twice the number that would have been enfranchised by Russell's measure. The zenith of Disraeli's political career was reached when he was Prime Minister from 1874-80. His government was responsible for the enactment of some legislation in the interests of social reform, "Tory socialism" as it was called; but Disraeli's interest in such matters lagged far behind his interest in foreign affairs. His imperialistic policies gave, or seemed to give, a greater prestige to Great Britain than was the country's lot when the Liberals were in office. His outstanding achievement was the purchase from the khedive of the Suez Canal shares, in 1875, which was popularly and rightly judged as a masterstroke. The next year, by the Royal Titles Act, Disraeli secured for Queen Victoria the title Empress of India, an accomplishment which gratified the sovereign, whatever it may have done for India. That same year Disraeli accepted a title, and, as Earl of Beaconsfield, took his place in the House of Lords. He was the dominant figure at the Congress of Berlin in 1878, after the Turco-Russian war, and claimed that he returned from the congress bringing "peace with honour." The correctness of the claim is open to question. Later, when Disraeli airily dismissed as "coffeehouse babble" the reports of Turkish atrocities in Bulgaria, GLADSTONE, ever an enemy of Turcophile policy, aroused the conscience of the country, and the Conservatives were overwhelmingly defeated in the elections of 1880. Disraeli died at Buckinghamshire on Apr. 19, 1881.

Gifted with a brilliant imagination, imbued with a firm belief in Britain's imperial destiny and successful in his foreign policy, Disraeli won and retained the confidence of Victoria as did no other of her prime ministers. In parliamentary debates, he was primarily a rhetorician, unsurpassed for the cleverness of his epigrams. In politics, he was an opportunist, yet far more than a mere opportunist; ever somewhat theatrical, he made his own the rôle he was playing. As a novelist, he was admirable in his powers of description, yet lacking in creative ability. His natural endowments were those of the race from which he

sprang, rather than those of the country to which his grandfather had migrated.

A. H. S.

BIBLIOGRAPHY.—W. F. Monypenny and G. E. Buckle, *The Life of Benjamin Disraeli*, 1910-20; E. T. Raymond, *Disraeli: the Alien Patriot*, 1925; D. L. Murray, *Disraeli*, 1927.

D'ISRAELI, ISAAC (1766-1848), English author, was born at Enfield, in May 1766. From boyhood he was a devoted student of literature. After considerable travel and study abroad, in 1790 he published *A Defense of Poetry*, and in 1791 the first of several volumes of *Curiosities of Literature*. His *Essay on the Literary Character* appeared in 1795, and *Calamities of Authors and Quarrels of Authors* between 1812-14. He was the father of BENJAMIN DISRAELI, Earl of Beaconsfield. He died in Buckinghamshire, Jan. 19, 1848.

DISSOCIATION, in chemistry, the separation of a substance into two or more constituents. There are two main types: chemical dissociation proper, in which each molecule decomposes into other molecules or atoms, each of which has an individual existence; and electrolytic dissociation, taking place in solutions, where the dissociation products are electrically charged groups of atoms, the existence of each of which is dependent upon the co-existence of the other.

There are also two types of chemical dissociation. In the first type, the opposite of ASSOCIATION—each molecule breaks up into other molecules or atoms without changing the proportions of the constituent elements. Thus, the colorless oxide of nitrogen, N_2O_4 , splits into two molecules of NO_2 , of a deep brown color. In the second type of chemical dissociation—the opposite of chemical combination—the dissociation products are dissimilar in composition, as in the case of ammonium chloride (see AMMONIUM COMPOUNDS) which dissociates into hydrochloric acid and ammonia, and of limestone which produces quicklime (calcium oxide) and carbon dioxide. Chemical dissociation increases as the temperature rises or as the pressure is lowered, and constitutes a reversible reaction. The amount of dissociation which has taken place may be judged from a resultant change in color, as in the case of the oxide of nitrogen and it may be measured by measuring the change in vapor density since one molecule gives rise to two or more.

Electrolytic dissociation is most pronounced in aqueous solutions, and its presence is inferred from the fact that such solutions show a greater decrease in freezing point and a greater increase in boiling point and osmotic pressure than could be anticipated from their concentration. Furthermore, their electrical conductivity is many times greater than that of water. The theory was accordingly proposed that substances dissociated into two kinds of ions, each of which was composed of a characteristic group of atoms and possessed an electric charge equal in amount but opposite in sign. The resultant increase in the number of particles in solution explained the change which was observed to take place in physical constants, while conductivity was explained by the fact

that each class of ions is attracted toward the electrode of opposite polarity, thus virtually producing a current in the liquid. See **IONIC THEORY**. W. J. L.

DISSOLUTION, as applied particularly to legislatures, refers to the termination of such a body, as opposed to mere prorogation or to the close of one session. Dissolution implies that bills which have failed of passage in the legislative body must start their course over again if they are to pass in the ensuing legislature. The chief executive usually possesses the power to dissolve the legislative branch. In most countries dissolution takes place automatically at the end of a designated period of years. S. C. W.

BIBLIOGRAPHY.—F. A. Ogg, *The Governments of Europe*, 1920.

DISTANCE RUNNING, the class of flat races over distances upward of 3 miles. One of the earliest known distance running events was the foot race in the Olympic Games of the Greeks. The marathon, so named after the village of that name, from which Pheidippides in 490 B.C. ran to Athens, a distance of 22 mi., is the classic distance event; its length has been regularized by modern **OLYMPIC GAMES** at 26 mi., 385 yds. Besides the marathon, distance running events include races over 4 and 10 mi., and the Olympic event over 5,000 m., or 3 $\frac{1}{4}$ mi. The distance records were held for many years by English runners; but after 1912 northern runners began to establish better time for all events up to 30 mi. All existing records between 30 and 100 mi. were broken after the World War by Arthur Newton, a South African farmer, who ran most of his phenomenal races at the age of 40. All records between 3 and 10 mi. were bettered between 1923 and 1930 by Paavo Nurmi, Finnish runner, who in 1924 also established a world's record of 14 min., 28 $\frac{1}{2}$ sec. for the 5,000-metre race. A new world's mark for the 15-mile race was set in 1902 by F. Appleby, of England, who covered the distance in 20 min., 4 $\frac{1}{2}$ sec. Other world records in distance running, recognized by the International Athletic Federation, are: 20 mi., G. Crossland, of England, 1 hr., 51 min., 54 sec., 1894; 25 mi., H. Green, of England, 2 hr., 29 min., 29 $\frac{1}{2}$ sec., in 1913; 50 mi., E. W. Lloyd, of England, 6 hr., 13 min., 58 sec., in 1913; and 100 mi., Arthur Newton, South Africa, 14 hr., 43 min., in 1927. Distance running requires long road training, and proficiency comes only when the runner learns to husband his strength by careful pacing. To hold himself rigidly to a definite pace for every stage, Nurmi frequently raced with a stop watch in hand. In the proper sense, there is no recognized distance racing in the United States, where the longest Amateur Athletic Union event is the 2-mile indoor championship.

DISTILLATION, the *vaporization* of a single constituent from a *solution*, as in "distilling" water; more properly, the vaporization of a liquid mixture, yielding a *vapor* containing more of these constituents in a nearly pure state. The basic requirement for a separation of two or more materials by distillation is that the composition of the vapor be different from that of the liquid from which it is formed.

Distillation is used to recover alcohol from its mixtures with water; to separate benzene, toluene and xylene from the light oil of the gas industry; to separate crude and cracked petroleum into gasoline, kerosene, naphtha, gas oil and lubricating stocks. The process of distillation is carried out in a still, and the supplementary processes of **FRACTIONATION** and **RECTIFICATION** are used to improve the separation.

DISTILLATION, DESTRUCTIVE. See **CARBONIZATION**; **WOOD DISTILLATION**.

DISTRESS, in law, seizure of a personal chattel to procure satisfaction for some wrong. At common law a landlord could distrain for non-payment of rent, and a land owner could distrain cattle for injury done by trespass on his lands. Also collectors of taxes may distrain to enforce payment. Distress has been abolished in many states, and very much restricted in others.

DISTRIBUTION CONCEPT, an anthropological term used in expressing the geographical distribution of culture traits in determining chronology and relative universality. Some culture traits with approximately universal distribution are the use and method of kindling fire, cooking by means of fire, some forms of spears and knives, magic and marriage or the union of a man and a woman formally recognized by the tribe. Traits of wide distribution include the bow, domestication of the dog, basketry, pottery and the belief in animism.

DISTRIBUTION OF WEALTH, the division of the ownership of valuable goods between individuals within a nation.

The best studies of wealth distribution have been made in Great Britain where Sir Josiah Stamp, basing his figures upon 1919 reports, estimates that two-thirds of British wealth is owned by 392,256 persons. These individuals constitute but 1% of the British population and but 2 $\frac{1}{2}$ % of those gainfully employed and over the age of 20. Considering the ownership of the upper stratum of British society, Stamp finds one-third of the wealth in the possession of but 36,000 persons, who constitute only one-fourth of 1% of those gainfully employed and over the age of 20.

A similar but slightly less marked inequality of wealth distribution has been noted for America in the studies of W. I. King and the **FEDERAL TRADE COMMISSION**. The Trade Commission bases its figures on a survey of all of the 43,512 estates probated in 24 counties of 13 typical states during 1912-23. It found that the richest 1.1% of the decedents were in possession of 58.9% of the total value of the estates. When this group was enlarged so that it included the richest 5.3% of the decedents, it was discovered that they owned altogether 81.9% of the total estate value. The poorest 79.8% of the decedents possessed but 5.4% of the total value of the estates. Indeed this lowest group, comprising in numbers the bulk of the wealth holders, averaged estates of less than \$500.

The study of W. I. King estimated the aggregate American wealth to have been \$281,159,000,000 on Dec. 31, 1921. This total included \$43,000,000,000

of corporate stocks, \$25,000,000,000 of the funded debt of corporations, \$25,000,000,000 of governmental bonds, and the remainder in individual property. Of the total, \$51,997,000,000 was held by farmers and \$229,162,000,000 by non-farmers. The average value of the wealth of a farmer was \$8,144 while that of a non-farmer \$6,638. The comparative average current incomes for the same year (1921) were \$701 for the farmer and \$1,600 for the non-farmer.

Viewing the distribution of wealth between individuals, King estimated that "the poorest half of the property owners apparently possessed only about 4% of the wealth. Half of the wealth belonged to the richest tenth of the property owners." The following cumulative table shows the situation in some detail:

Wealth per Person	Per Cent of Wealth Holders	Per Cent of Wealth Held
More than \$40,000	2 00	40 19
More than \$10,000	10 73	65 10
More than \$5,000	21 72	76 08
More than \$2,000	57 40	92 23
More than \$1,000	87 07	98 73

Louis Corey, in a study of class distribution of capital resources, estimated that farmers, who constitute 14.6% of those gainfully employed possess 12.3% of the total capital. Workers, who comprise 63.0% of the total group, hold 4.0% of the capital. The remaining 83.7% of the capital is held by non-wage earners, who total 22.4% of the group.

C. E. W.

DISTRIBUTOR, a switch, usually rotary, for distributing electric impulses to desired points in a given sequence. The distributor is commonly employed in connection with gasoline engines (*see* INTERNAL-COMBUSTION ENGINES) for connecting the spark plugs with the inner ignition coil and battery, or magneto, at the proper time for igniting the charges in the cylinders. The distributor has the same number of segments as there are cylinders in the engine, each being connected to a spark plug. The mechanism controlling the rotating arm, which makes contact with the segments, is geared to the engine so that it makes one revolution to two revolutions of the crank-shaft (in four-stroke-cycle engines). The distributor head, which contains the segments, is provided with a manual or automatic advance-retard mechanism which regulates the time of ignition with respect to the position of the piston in accordance with the speed of the motor.

The term distributor is also applied to a switch for distributing an electric current to two or more circuits in parallel.

A. Z.

DISTRICT ATTORNEY. In England, down to 1879, all criminal prosecutions were privately conducted. In America, in the first years of the eighteenth century the colonies began to do away with private prosecutions and to set up public prosecutors. The first statute was enacted in Connecticut in 1704. Various names are given to local prosecutors in the several states, but for the most part they are called district

attorneys, prosecuting attorneys or county attorneys. The Federal Judiciary Act of 1789 provided for a United States Attorney in each federal judicial district. The duties of these district or prosecuting attorneys are to conduct public prosecutions, and to take such part in criminal investigation as may be necessary to make the work of prosecution effective. In the federal polity the United States attorneys are under control of the Department of Justice. But in the states generally each local prosecutor is more or less completely independent of any central control.

DISTRICT OF COLUMBIA, a political entity, co-extensive with the city of WASHINGTON, the capital of the United States, comprised of 60 sq. mi. of land and 10 sq. mi. of water surface, located on the Potomac River between Maryland and Virginia, 40 mi. southwest of Baltimore.

The land is low and partly marshy along the Potomac River, but farther inland is rolling and in some places sharply hilly. It is traversed in the southern part by the Anacostia River, or Eastern Branch, and in the northwest part by the beautiful gorge of Rock Creek.

A total of 3,071 acres, or 7% of the area, is in farms, which produce mainly garden vegetables and dairy



DISTRICT OF COLUMBIA SEAL

products. Floriculture is an important activity in the city and suburbs. A number of industries are carried on in the district, the more important of which are under the Federal government and include printing by the Bureau of Engraving and Printing, by establishments of the Geodetic Survey, Geological Survey and Department of State, and the manufacture of scientific instruments for the Smithsonian Institution and various Government bureaus.

By an act of Congress of July 16, 1790, amended Mar. 3, 1791, it was provided that after 1800 the Federal Capital should be moved to a district or territory not exceeding 10 miles square on the River Potomac between the mouth of the Eastern Branch and the Conogochague. The original territory included 69¼ sq. mi. ceded from the state of Maryland and 30¼ sq. mi. from the state of Virginia. In 1846 the part taken from Virginia was ceded back by the government as the result of a petition by its inhabitants.

Within the area was located the Indian village of Powhattan, visited by Captain John Smith in 1608. In 1663 a plantation was established by Francis Pope. Georgetown was settled around 1665, and a town laid out in 1751 and incorporated in 1789. When the territory was taken over by the Federal government, Georgetown was the only municipal corporation within the area, the remaining part being administered by various justices of the peace. The part laid out as the city of Washington was governed at first by

commissioners appointed by the President and later by a city council form of government. In 1871 the whole District of Columbia was united under a territorial government, and in 1878 the present permanent form of government was adopted in which the administration is vested in three commissioners appointed by the President of the United States and approved by the Senate.

Since the purpose of the independent status of the district is that those connected with the workings of the government should be free from politics, the citizens do not have the right of vote in Municipal or Federal matters. Pop. 1920, 437,571; 1930, 486,869.

DITTANY, a name given to several ornamental perennial herbs frequently grown in gardens. The garden dittany (*Dictamnus albus*), of the rue family, native of the Old World, is a strong-smelling plant, somewhat woody at the base, bearing clusters of showy, white, pink or rose-violet flowers. The common dittany (*Cunila origanoides*), of the mint family, a much branched, profusely blooming plant, native to the eastern United States, bears clusters of small white or purplish flowers.

DIURETICS, agents which increase the secretion of the urine. This is done in a variety of ways. Water increases the quantity of urine passed. Any freely soluble, absorbable and relatively harmless substance taken into the system in considerable quantity, be this salt or sugar, increases the amount of urine by carrying some water with it in its elimination through the kidney. Substances that are foreign to the system, like saltpetre or sugar of milk, are likely to be efficient as diuretics in smaller doses than those normally contained in body fluids.

There are, however, certain substances produced in the system as a result of the vital processes, such as the xanthin bodies, that have so special a tendency to stimulate the kidney secretion, that a small quantity produces a much greater increase than any of the previously mentioned agents. They do this, partly at least, by increasing the blood supply to the kidney. It is evidently because of their chemical relationship to these xanthin bodies that caffeine and theobromine, the alkaloids of coffee and cacao respectively, are so efficient as diuretics. (See also **CAFFEINE**). Numerous volatile bodies, such as aromatic oils, as well as various ethers and alcohols, and salts of certain heavy metals (mercury) exert a special irritative effect upon the kidneys which in moderate doses, increases kidney secretion, but in large doses produces kidney inflammation or degeneration.

There are some drugs which, while not acting as diuretics in normal individuals, are often capable of increasing the quantity of urine in patients with dropsy from heart disease. Among these digitalis is the most prominent. It acts by improving the circulation through the kidney as a result of improved activity of the heart. B. F.

DIURNAL CIRCLE, the apparent path described by a star in the sky, as a result of the rotation of the earth. It is parallel to the celestial equator.

DIVER, a name given to the members of a family (*Gaviidae*) of large water birds found in all northern regions and noted especially for their remarkable quickness in diving. Among the most widely distributed is the great northern diver (*Gavia immer*), generally known in the United States as the common loon. By some authorities the name diver is applied also to the grebes, a closely allied family (*Colymbidae*), the two groups formerly being regarded as forming the order of divers or diving birds (*Colymbiformes*). See also **GREBE**; **LOON**.

DIVERS AND DIVING APPARATUS. See **SUBMARINE DIVING**.

DIVIDENDS, the income return on stockholders' investments. The net profits of an enterprise belong to the stockholders, and they may be retained for corporate purposes or distributed as dividends. Certain fundamental conditions should obtain before dividends are paid. There must be a surplus, since dividend payments must not impair **CAPITAL**; the financial condition of the company should be sound; ordinarily, there must be a declaration by the **DIRECTORS**, as the amount, regularity and form of payment are questions of financial policy.

Dividends may be paid in cash, stock, bonds, scrip or property. Cash is most acceptable to the stockholder, and stock constitutes the next most popular form. Stock dividends are usually paid when the surplus is large and the company undercapitalized. Dividends payable in bonds are rare, although, following the World War, some corporations paid dividends in Liberty bonds. At times, stocks of other corporations, originally acquired for a special purpose which no longer exists, are distributed as dividends. Scrip dividends are promises to pay cash at a subsequent date when the financial condition of the company is improved. Dividends on preferred stock should be paid, if earned and they may accrue as a claim to be liquidated in full before the common stockholders are entitled to any return. By implication, the corporation binds itself to pay dividends on non-cumulative preferred stock, if earned.

In contrast to dividend payments out of profits, there are liquidation dividends. These are paid as a step in winding up a business and constitute a return of capital. A modification of this form exists with mining and other enterprises possessing depleting **ASSETS**. The amount paid may consist of payment out of earnings, out of capital, or a combination of both. T. C. J.

DIVIDING ENGINE, a machine used to cut fine lines at regular intervals in the graduation of circular or linear scales and in the construction of various physical instruments and commercial precision machines (see **MEASURING TOOLS**). The linear dividing machine essentially comprises an accurately cut screw and nut and a diamond point cutter which moves at right angles to the axis of the screw. The piece to be graduated is clamped to the nut and is moved through a certain distance along the axis of the screw by rotating the screw, thus providing the interval between graduations. The circular type of dividing machine

comprises a toothed revolving table which is rotated through a certain distance by revolving a screw which is in mesh with its teeth. It has a cutter which moves parallel to the surface of the table from its center to its circumference. Both types are operated automatically to obtain the desired graduations. Lines as fine as 0.0001 in. can be cut to an accuracy of 0.0001 in. for linear machines and to 1" of an arc for circular machines.

DIVINATION, the art of reading the issues of coming events or ventures in signs in nature or by artificial systems. It passes over to the general practices of fortune-telling, and the many varieties of "mancy," such as **CHIROMANCY**, reading fate in the lines of the hand; **BIBLIOMANCY**, picking texts in the Bible; **CARTOMANCY**, by means of cards; or to such popular customs as reading tea leaves, or again finding water or ore by the **DIVINING-ROD**; or gazing in a reflecting surface (*see* **CRYSTAL GAZING**) and interpreting the passing visions. The "prophetic" interpretation of dreams would likewise be a form of divination.

To begin with, divination is seeking a sign of the will of the gods; the adept in such practice is the seer, priest, or the inspired **ORACLE**, or mouth-piece of the gods, who may speak in a trance or give vague prophecies capable of many interpretations. Omens and portents are developed by fanciful elaboration of incidents supposed to bring good or evil luck. Divination by birds (*see* **AUGURY**) is a typical example. Such practices are set in a system of **MAGIC** in which the secrets of nature must be guessed by mystical signs and symbols, and would be classified, as they survive, as **SUPERSTITIONS**.

In more primitive setting divination might follow such a ceremony as giving a name to a new-born child by speaking a succession of names and awaiting some sign when the right one is spoken. This in turn might be connected with a belief of a return in the child of a spirit of an ancestor. Casting of lots is a form of divination, of which counting out rhymes is a folk-lore descendant. J. J.

DIVINE COMEDY, THE (*La Divina Commedia*), the greatest poem of the Middle Ages and one of the greatest of all times, written by DANTE probably in the first quarter of the 14th century. The *Comedy*—not called *Divine* by the author, the epithet first appearing on the title-page in the 16th century—is a godlike allegory of mysticism and religious aspiration, intended less to delight mankind than to rebuke and exhort it, and stands as the supreme all-embracing expression of medieval thought and culture. The hundred cantos, written in the famous *terza rima*, are divided into three parts, to meet the needs of the poet's progress through the three stages of his sublime vision of Hell, Purgatory and Paradise. The action extends through six days, and opens on the Friday before Easter in the year 1300, when Dante finds himself lost in a forest, beset by wild beasts, the earthly sins of Pride, Avarice and Lust. Virgil appears in a vision, and together the two poets begin

their journey through the universe, starting with a descent through the nine circles of Hell—where they see and speak with the tortured souls—and ascending then through the less terrifying slopes of Purgatory, at the peak of which Virgil turns back, entrusting Dante to BEATRICE, who personifies Divine Philosophy. Guided by the radiant Beatrice, and finally by St. Bernard, typifying Divine Contemplation, the poet tastes of the joys of eternal life and, through the intercession of the Virgin, at last of those of the Beatific Vision.

BIBLIOGRAPHY.—Standard text: *Le Opere di Dante*, Società Dantesca Italiana, Florence, 1921; blank verse trans. by H. F. Cary, 1814; metrical trans., H. W. Longfellow, 1867; prose trans., C. E. Norton, 1893, 1920; C. A. Dinsmore, *Aids to the Study of Dante*, 1903; H. D. Sedgwick, *Dante*, 1918; C. H. Grandgent, *Discourses on Dante*, 1924.

DIVINE RIGHT MONARCHY. The theory that monarchy is of divine institution and that kings are accountable only to God, with, as corollaries, the indefeasibility of hereditary right and the religious duty of nonresistance and passive obedience, first emerged in the contest between popes and emperors in the 14th century. It then meant that the Empire had a divine right to freedom from papal control. In England the theory was advanced in the 16th century to justify the antipapal position of Henry VIII and Elizabeth. The doctrine of hereditary right brought forward in 1399 was in abeyance under the Tudors, but was emphasized by James I, who acquired the throne in accordance with the hereditary principle and in violation of acts of Parliament. Already in Scotland he had advanced the divine right theory in opposition to the pretensions of the Presbyterian clergy. In the 17th century divine right was political rather than religious in significance; the principle of heredity and the doctrine of passive obedience owed their importance to the struggle with Parliament and the Cromwellian regime. The most complete expression is to be found in the Restoration period. After the Revolution of 1688 it was in England little more than a romantic theory, yet it had played an important part in developing the idea of sovereignty and in securing continuity of political institutions. On the continent the reign of Louis XIV in France affords the best illustration of divine right monarchy, and the theory continued much later.

DIVING, a running or standing plunge headforemost into the water. In recent years the practice has grown in popularity in the United States and in Europe, due partly to the new importance of diving events in the **OLYMPIC GAMES**. While a graceful dive appears an effortless feat to the uninitiated, the fact is that even the correct execution of a simple dive requires a nice combination of timing and balance. The more complicated dives, involving simple and double somersaults, may be said to belong to the art of acrobatics. Simple diving from a springboard or a stationary take-off requires chiefly the ability to spring. The arms are stretched over the head, the hands forming the point of the body first to enter the water; the head is sunk between the arms, and thus is partially

protected from the impact of the water. In diving, the spring should, as it were, direct the weight of the body toward an imaginary point in the water, while the diver gives a final flip, or impulse, with his toes, which throws up his legs. The legs should be perfectly straight, close together, the toes pointed. After this elementary stage, the beginner may with practice become adept at the jack-knife dive, in which the body is straightened from a doubled position just before entering the water; the swallow dive, executed with the arms outspread and head held back; and the screw, a twisting dive, in which the body takes four positions before striking the water. In the 1924 and 1928 Olympic Games, American entrants won the diving events without serious competition.

DIVING BELL, a hollow air-tight chamber, usually in the form of a bell or cylinder, open at the bottom and provided with apparatus for supplying it with compressed air to keep the water out. It is lowered into water with persons inside. Bells have been employed in underwater work of many kinds, but advances in the art of SUBMARINE DIVING have made them more or less obsolete. *See also* CAISSONS.

DIVING BIRDS, a name given to various aquatic birds noted for their exceeding quickness in diving, including the loons (*Gavidae*) and the grebes (*Colymbidae*). *See also* DIVER; GREBE; LOON.

DIVINING ROD, a forked twig, usually hazel, used by a "diviner" to find underground water, and later, oil and metals also. The indicating is done by the dipping of the rod and is a widespread practice. It is an instance of the belief in the possession of special powers by peculiarly sensitive persons. Similar beliefs are those in SECOND SIGHT and prophecy. The explanation lies in the involuntary movements (*see* AUTOMATISMS) of the diviner, or "dowser" as he is called in England, whose general familiarity with the lay of the land where water is likely to be found leads him to induce the movement, while yet convinced that the force is one outside himself. J. J.

DIVISION, the process by which, given the product of two numbers and one of those numbers, the other is found. For example, if the product is $8\frac{1}{2}$ and one number $2\frac{1}{2}$, the other number is $3\frac{1}{4}$. If we extend the meaning of "times" to include fractions, surds, transcendental and other non-integral numbers, the following old definition is admissible in certain cases: "the process of finding how many times one number is contained in another, or the separating a number into a given number of parts." In the case of 7 divided by 2, 7 is the dividend, 2 is the divisor, and $3\frac{1}{2}$ is the quotient; but sometimes it is said that the quotient is 3 and there is a remainder of 1. The two common types of division, *long division* and *short division*, are sufficiently explained in the arithmetic textbooks. There is a variant of long division, sometimes called Austrian division, in which the partial products at each step are not written, but it is too difficult for most children. One number is said to be divisible by another if the quotient is an integer. *See* ARITHMETIC.

DIVISION, in the Army, the combat and tactical maneuvering unit of the combined arms. It comprises the essential combatant and administrative branches in its organization, all in correct proportion and so organized as to make it self-sustaining. The infantry division is the basic field army organization. In the United States Army its present strength is approximately 20,000.

In the Navy a division is one of the secondary groups into which a FLEET or a SQUADRON is divided; also a subclassification of a ship's company, depending, in general, upon the battery designation and its location on the vessel. A division is ordinarily composed of four ships, but the number may be increased to six or decreased to three.

BIBLIOGRAPHY—General Service Schools, Ft. Leavenworth, *Tactics of Combined Arms*.

DIVORCE, the legal dissolution of the MARRIAGE ties. The primitive causes for divorce, which has existed from early times, were witchcraft, drunkenness, laziness and adultery; in some tribes, the husband could repudiate the wife for no reason at all.

In Rome it was considered immoral for any one to promise not to exercise, under any circumstances, the right to divorce. This held until the Middle Ages when the Church assumed jurisdiction over marriage. The Church belief that marriage was indissoluble determined the law of all Europe. In his encyclical in 1931, Pope Pius XI remained adamant on the question of divorce and Roman Catholics in all countries adhere to the Church views.

The Roman Catholic law always has permitted an annulment on the basis of impedimenta which existed at the time of marriage—disease, impotency or fraudulent contract—but the ties cannot be dissolved for any subsequent misfortune or misconduct. Divorce was a part of the program for the French revolution.

While the Christian idea is that marriage is a religious pact, the civic idea is that it is a social institution and its dissolution is a legal matter. Causes for divorce are therefore determined by law. In many countries and states, incompatibility and unconquerable aversion are grounds for separation only, though sometimes, after a term of years, divorce is granted. In the United States adultery is a primary cause for absolute divorce in any state.

There is no uniform divorce law in the United States and there is a great variance among the states concerning divorce and re-marriage.

South Carolina grants no divorce and New York and the District of Columbia for one cause only, adultery. Causes in other states include impotency, habitual drunkenness, insanity, cruelty, conviction of felony, failure to support and willful desertion. Nearly two-thirds of all divorces are granted to wives. When granted to the husband, he does not have to pay ALIMONY. Only in a few states is the wife ever compelled to pay alimony. Most states require a year's residence or more before suit may be brought. Nevada, requiring only six weeks' residence (three months

previous to 1931), is known as the nation's divorce center.

There has been a steady increase in divorce in all civilized countries except Japan, the United States maintaining the highest rate. In 1886 there were over 25,000 divorces in that country and, in 1916, 112,000; an increase nearly four times as rapid as the increase in population. In 1929, there was one divorce to every 6.1 marriages. More than 100,000 children are affected by divorce each year.

Many feel that relationships between men and women are society's concern only when there are children. To insure the stability of the family, they suggest an experimental seeking of mates, or trial marriages (see MARRIAGE). It is a question if more strict divorce laws are the solution; tales of extreme cruelty are often concocted to get divorces in cases of mere incompatibility, and situations are faked in states where adultery is the only cause. R. M. U.

DIX, JOHN ADAMS (1798-1879), American soldier and statesman, was born at Boscawen, N.H., on July 24, 1798. After attending Phillips Exeter Academy, he was sent to the college of Montreal to learn French and familiarize himself with a different culture. At 14 he was a cadet in the American army, and served during the War of 1812. Resigning his captaincy, he was admitted to the bar in 1824, moved to New York state, and in 1830 became state Adjutant-General. He was New York's Secretary of State, 1833-39. In 1845 he entered the United States Senate as an anti-slavery Democrat. In 1861 he served as Secretary of the Treasury under Buchanan. He was Minister to France, 1866-69, and in 1872 was elected on the Republican ticket to the governorship, but was defeated for reelection two years later. He died in New York on Apr. 21, 1879.

DIXIE HIGHWAY, a thoroughfare of the eastern United States, running north to south from Lakes Michigan and Huron to Miami, Fla. From Chattanooga northward this road is laid out in the shape of a loop, the western or "B" line running through Tennessee, Kentucky, Indiana, Illinois and Michigan where its course follows the lake shores and merges with the eastern or "A" line. This division traverses Ohio, Kentucky and Tennessee back to Chattanooga. From the latter point the road crosses Georgia to Tallahassee, Fla., runs eastward to Jacksonville and then south to Miami. It is paved or improved throughout and covers a distance of 3,989 mi. The 144 counties it serves contributed \$10,000,000 for its construction. Being a direct connection of industrial centers of the north and south, this highway is of great commercial importance. It passes through Detroit, Chicago, South Bend, Indianapolis, Toledo, Cincinnati, Louisville, Lexington, Nashville, Knoxville, Chattanooga, Atlanta, Tallahassee, Jacksonville and Miami. It is designated by a rectangular white marker crossed by a band of red with "D H" in white.

DIXON, ROLAND BURRAGE (1875-), American anthropologist, was born at Worcester, Mass., Nov. 6, 1875. He was graduated in 1897 at

Harvard, where he was instructor of anthropology during 1901-6, assistant professor in 1906-15, and in 1916 was appointed professor of anthropology. He was elected president of the American Folk-Lore Society in 1907 and 1908, and in 1913-14 served as president of the American Anthropological Association. In 1918-19 he was a member of the staff of the American Commission to Negotiate Peace, at Paris. His works include *Oceanic Mythology*, *Racial History of Man* and *The Building of Cultures*.

DIXON, a city and county seat of Lee Co., northwestern Illinois, situated on the Rock River, about 100 mi. west of Chicago. Bus lines and the Illinois Central and Chicago and Northwestern railroads serve the city. It also has an airport. The manufactures are condensed milk, wire, shoes and cement. In 1828 a half-breed Indian established a ferry across the Rock River. Two years later the settlement was named Dixon for Father John Dixon, the first settler. The site of the old block house on the river, now marked by a bronze statue of Abraham Lincoln, recalls the Black Hawk War and the meeting on this spot of Col. Zachary Taylor, Lincoln and Jefferson Davis. Pop. 1920, 8,191; 1930, 9,908.

DIX RIVER DAM, located on the Dix River, Ky., is the second highest rockfill dam in the world, being 275 feet high above the bottom of the gorge in which it is built. The rock of which it is constructed is limestone. It contains 1,747,000 cubic yards of loose rock fill and has a crest length of 1,020 feet. The top width is 20 feet and the maximum thickness at the base about 700 feet. The upstream face, formed by a layer of large derrick-placed rocks, is 22 feet thick at the base of the dam and 7 feet thick at the top. On this rests a waterproof facing of reinforced concrete varying in thickness from 18 inches at the bottom to 8 inches at the top. It stores water for a hydroelectric power plant located just below the dam. The spillway is a large canal excavated through the rock at one end of the dam.

DJAMBI. See JAMBI.

DMITRIEVSK, a city in the north of the Ukrainian S.S.R. in southwestern Russia. Dmitrievsk's growth has been continuous since 1917, when the mineral wealth, mostly of coal, began to be exploited. There are important factories here for manufacturing chemicals, metal goods and other products. Pop. 1926, 51,471.

DNEPROPETROVSK, formerly Ekaterinoslav, an important city in central Ukrainian S.S.R., situated on the right bank of the Dnieper River, in southwestern Russia. It is above the rapids where one of the largest hydroelectric power stations in Europe was officially opened on Oct. 10, 1932. Nearby are vast stores of coal, iron and manganese; steel and iron-works of the first magnitude have arisen, including one of the largest cast-iron producing factories in the Soviet Union. As a railroad center and river port, with the Black Sea nearby, the city is an outlet for agricultural and mineral products.

Founded in 1787, Dnepropetrovsk did not de-

velop industrially until the beginning of the 20th century, when foreign capital began to exploit its mineral resources. The community's stormy history has included frequent insurrections and strikes. It is the cultural center of the region, with museums, a mining institute, colleges and several theaters. Potemkin's Palace is now a hospital. Pop. 1926, 232,925.

DNIEPER, the second largest river of Russia, and the third largest in Europe. From its source in the Smolensk province it runs generally south, winds southeastward to Dnepropetrovsk, and thence follows a southwesterly direction to empty into the Black Sea beyond Kherson. Its length is approximately 1,400 mi. and its drainage area is estimated at over 200,000 sq. mi. Traversing for the most part grassy plains and rolling country, the river encounters in its southerly course 25 mi. of rapids which obstruct navigation and are the cause of many perils which have been described in Byzantine chronicles and works of antiquity. Obstruction has been lessened by a ferro-concrete dam, built by American engineers in 1927. Fisheries abound in the southern portion of the river. The Dnieper's freedom from ice for two-thirds of the year has led to its development as a commercial waterway, and to the consequent situation of important cities along its banks: namely, Kiev, the "Holy Town" of Russian tradition; Smolensk and Dnepropetrovsk. Among the Dnieper's principal affluents are the Pripiet, Berezhina, Desna and Soj rivers.

DNIESTROSTROY DAM, located on the Dnieper River near Kitchkas, Ukraine, Union of Soviet Socialist Republics, was constructed for the improvement of navigation and the generation of electric power. Its total length including power house and lock is 5,000 feet. The spillway which forms half of this length is a concrete, gravity type dam rising 138 feet above the river bed and surmounted by steel gates 31.5 feet high. The deepest foundations are about 30 feet below the river bed and at that level the base width of the dam is 131 feet. The masonry in the dam power house and lock has a volume of 1,600,000 cubic yards.

DNIESTER, an important river in southeastern Europe, 800 mi. long, draining an area of almost 30,000 sq. mi. The river rises in the northern slopes of the Galician Carpathian Mountains, and following a southeasterly direction winds through fertile farming lands and bare steppes, finally debouching into the Black Sea in the neighborhood of Odessa. Spring floods and aridity in the late summer, also the presence of whirlpools and rapids at Jampol make navigation variable and difficult in turn. The severance of diplomatic relations between Russia and Rumania greatly lessened river traffic. The many villages which line the Dniester's banks derive their revenue from the sale of carp, sturgeon and other fish teeming in its waters, and from the export of caviar. The Dniester forms the boundary between Rumania and Russia which has been greatly disputed since the Russian Revolution of 1917.

DOBBS FERRY, a village in Westchester Co., southeastern New York, situated on the east bank of the Hudson River, 20 mi. north of New York; it is served by the New York Central Railroad. The printing plant of the Methodist Book Concern located here offers the chief industrial activity. Dobbs Ferry has an exclusive residential community with handsome homes. The Masters school for girls is located here. Jeremiah Dobbs who ferried travellers back and forth in his skiff founded the village in 1775. It was the scene of considerable activity in the Revolution. Pop. 1920, 4,401; 1930, 5,741.

DOBRUJA, THE, a district of southeastern Rumania lying between the Danube and the Black Sea and bounded by Bulgaria on the south. Its population of 700,000 persons is very mixed; but Bulgarians form a principal portion. The Turks conquered Dobruja in the 14th century and were nominally its rulers until 1878, when the CONGRESS OF BERLIN awarded it to Rumania in exchange for Bessarabia which Russia annexed. This change was not desired by Rumania, for about three-quarters of the inhabitants of Bessarabia are Rumanian and it is a very valuable agricultural region, while Dobruja is much smaller, is rather arid and is of little value except for the port of Constanza. The TREATY OF BUCHAREST, 1913, extended the boundary 30 miles southward at the expense of Bulgaria. In 1919 the Central Powers awarded the south half of the district to Bulgaria and established a condominium of the northern half. After the World War, the Treaty of Neuilly, 1919, restored the status of 1913, and this has been retained since. The Rumanian policy of repression and expulsion of the Bulgarian population has been notorious and has been a source of serious friction between Rumania and Bulgaria.

DOBSON, AUSTIN (1840-1921), English author, whose full name was Henry Austin Dobson, was born at Plymouth, Jan. 18, 1840. He was educated at Beaumaris, Coventry and Strasbourg. He was active in the Board of Trade from 1856-1901. His first poems, published in magazines in 1868, attracted favorable attention. These were followed by many volumes of poetry, including *Vignettes in Rhyme*, *Proverbs in Porcelain* and *Old World Idylls*. He helped to introduce into England several French verse-forms, among them the TRIOLER and the RONDEAU. His prose includes *The Paladin of Philanthropy*, 1899, and lives of Hogarth, Fielding, Steele and others. Dobson died Sept. 2, 1921.

DOBSON, FRANK (1889-), English sculptor, was born in London, in 1889. He studied under George Harcourt, at Arbroath, and began to exhibit in 1920. Since then he has exhibited at various places in Europe, and in 1928, in America. His works include *The Concertina Man*, *The Man Child*, *Woman Descending from a Bus*, *Cornucopia*, *Siesta*, *Noon*, and modeled portraits of Tallulah Bankhead, Capt. R. Wyndham, Lydia Lopokova and L. H. Myers.

DOBSON-FLY, a large insect of the order *Neuroptera* (or *Megaloptera*). The adult possesses

membranous wings with many veins. It may have a wing spread of more than 5 in. Adult males have very long mandibles; those of the females are much shorter. Eggs are laid in summer, in chalky masses attached to stones or other objects overhanging the water. Larvæ at once find their way to the water. Here they live under rocks in the stream bed, usually in swift currents. They are predacious, feeding upon smaller aquatic insects. When nearly three years have elapsed, the larvæ leave the water to pupate under rocks or logs near the bank. Adults emerge in about a month. The larvæ are much used as bait, especially for bass. Fishermen know them as hellgrammites, dobsons, or hell-devils.

DOCETISM (from the Greek *dokein*, to seem), the doctrine, prevalent in the days of the early Christian Church, that the body of Jesus Christ was not real or material, but merely apparent. It grew from the idea that matter is inherently evil and irreconcilably opposed to the Divine. A milder form of Docetism was the belief that the body assumed by Christ, although substantial, was of an ethereal or celestial substance. Those who held this heretical doctrine were named Docetae. The doctrine was included in the tenets of Gnosticism and Manichæism, and a number of other sects. Among individuals who held Docetic views were Marcion, Docitheus, Saturninus, Tatian and, to some extent, Origen.

DOCK, in botany, the name given to several plants belonging to the genus *Rumex* of the buckwheat family, closely allied to the sorrels. They are mostly coarse perennial herbs rising from stout rootstocks and bearing large smooth, usually wavy-margined leaves and small greenish flowers arranged in whorls forming a small panicle. Among the common forms widely distributed as weeds are the broad-leaved dock (*R. obtusifolius*), growing 3 ft. high with very large heart-shaped root-leaves sometimes over a foot long, the curly dock (*R. crispus*) with narrower very wavy-margined leaves often 10 in. long, and the fiddle dock (*R. pulcher*), with oblong or fiddle-shaped leaves about 6 in. long. Various other plants are styled dock as burdock, spatter dock and velvet dock.

DOCKS, artificial basins for accommodating vessels. They are usually filled with water. In northwestern Europe, where the TIDE range is great, they are provided with Locks so that ample depth of water may be maintained at all stages of the water inside. Such are the docks of the ports of London, Liverpool, La Havre and Bremerhaven. WHARVES, QUAYS and PIERS are often incorrectly called docks. See also DRY DOCKS; FLOATING DOCKS.

DOCTOR OF MEDICINE. See PHYSICIAN.

DOCUMENTARY BILL, a BILL OF EXCHANGE to which shipping documents are attached. It is customarily drawn by the seller on the buyer, for the purchase price of goods sold, and the shipping documents control the transit and delivery of the goods. Bills are drawn either at sight or at a tenor which normally runs for 60 or 90 days. In the case of sight bills, the documents are customarily surrendered only

upon payment of the bill which in the case of time drafts, the documents are usually surrendered to the drawer upon acceptance of the bill, although they are sometimes retained until payment.

The shipping documents consist of a BILL OF LADING, which is the written acknowledgment of the receipt of the goods into custody by a transportation company and an agreement to transport to a designated place: an insurance certificate to protect the parties interested against loss or damage to, or general average claim, against the goods: an INVOICE itemizing the charges which go to make up the amount of the bill; and any other documents or certificates made necessary by regulations of the port through which the goods are to be cleared. Both bill and shipping documents are drawn in negotiable form (see NEGOTIABLE INSTRUMENTS) and in a plural number of copies or set. The bill is both self-securing and self-liquidating, making it a highly desirable type of COMMERCIAL PAPER.

W. W.

DOCUMENTING VESSELS, as required by the U.S. Treasury Department and the various terms used, is as follows. The term document refers to a regular marine document issued at the Custom House such as certificate of registry, enrollment and license, or license (for a vessel of 5 and not over 20 tons net burden).

To document a vessel never before documented it is necessary to produce a certificate from the builder, setting forth the name of the vessel, when, where and for whom built, and such other data as descriptive of the vessel.

This certificate must be presented to the admeasureur of vessels (Surveyor's Office, Custom House) and application made to have the vessel officially admeasured.

The surveyor will issue a certificate of admeasurement which, with the builder's certificate, must be presented at the marine division of the Custom House, and application made for the assignment of an official number. This number and the vessel's net tonnage must be marked on the main beam and such marking certified to by an inspector of customs.

The owner and master of the vessel must then appear at the marine division of the Custom House and make oath as required by law; whereupon the marine document will be issued.

The home port of a vessel is the place where the permanent document of a vessel is issued. Each bill of sale, conveyance and mortgage should be recorded at the home port.

BIBLIOGRAPHY.—U.S. Customs Service, Treasury Department, publications on documenting vessels.

DODDER, the common name given to a large genus (*Cuscuta*) of parasitic plants of the morning-glory family, known also as strangeweed and love-vine. There are about 100 species found widely throughout the world, some 30 of which occur in North America. They are slender annuals, completely destitute of green foliage, with thread-like reddish or yellowish stems twining about other plants

(hosts) and bearing small, usually white flowers. Sucker-like structures developed by the dodder stem penetrate the host plant and absorb food from its tissues. The Old World flax-dodder (*C. Epilinum*) and clover dodder (*C. Trifolii*) are destructive to crops, as is sometimes the common American dodder (*C. Gironnii*).

DODECAHEDRON, a solid figure of 12 faces (Greek *dodeka*, 12, + *hedra*, seat). A regular dodecahedron is one of the five regular polyhedrons, that is, polyhedrons having congruent regular polygons as faces and equal polyhedral angles. See POLYHEDRON.

DODECANESE, a group of 13 Aegean islands belonging to Italy and lying off the southwest coast of Asia Minor. *Dodecanese* means 12 islands in Greek, and originally the name referred to 12 islands, but since Italy has occupied the group and an additional one was added in 1912, the name applies to 13 islands. RHODES is the largest and most important of the group. The other twelve are COS, KARPATIOS, PATMOS, LIPSOS, LEROS, KALYMNOS, NISYROS, ASTYPALAI, TELOS, SYMI, KASOS and KHALKE. Most of the inhabitants are Greek. Sponge fishing is the chief industry. Considerable quantities of fruits and vegetables are grown and exported to Egypt.

Italy occupied the islands, taking them from Turkey in 1912, and ever since the Dodecanese have been a diplomatic problem, since Greece claims them on ethnological grounds and Great Britain has looked with favor on Greece's claim. The Italians, however, have already established a university at Rhodes and a naval base at Leros, which indicates that they plan to keep the islands permanently. The city of Rhodes is the capital of the administration. Other important towns are Kalymnos, Cos and Symi. Est. pop. 1931, 100,000.

DODGE CITY, a city in southwestern Kansas, county seat of Ford Co., situated on the Arkansas River, 115 mi. west of Wichita. Two railroads serve the city. There is an airport. Farm crops, especially wheat, poultry and live stock are produced in the vicinity. The local industries are flour milling, railroad shop work and poultry-dressing. The retail trade in 1929 reached the sum of \$10,267,121. In the early days of cattle driving Dodge City was an important point on the old Sante Fé Trail and the headquarters of the cattle business. The American buffalo were abundant in this region, where they were ruthlessly slaughtered. The city is on the meridian which divides Central from Mountain Time. Dodge City was founded about 1872 and incorporated in 1875. Pop. 1920, 5,061; 1930, 10,059.

DODGSON, CHARLES LUTWIDGE (1832-98), English mathematician, better known as "Lewis Carroll," the author of *Alice's Adventures in Wonderland*. He was born at Daresbury, Cheshire, Jan. 27, 1832, the son of a clergyman, and was educated at Rugby and at Oxford. From 1855-81 he lectured on mathematics at his college, Christ Church, Oxford, and in 1861 he took church orders. He published several books on advanced mathematics, in-

cluding *A Syllabus of Plane Algebraical Geometry*, 1860, *An Elementary Treatise on Determinants*, 1867, *Euclid and His Modern Rivals*, 1879, and *Curiosa Mathematica*, 1888. A quiet, scholarly man, disliking publicity, he adopted the pseudonym of "Lewis Carroll" when, in 1865, he published *Alice's Adventures in Wonderland*. Written to entertain a young daughter of Dean Henry George Liddell of Oxford, the book was immediately successful, owing something of its widespread appeal to the illustrations by Sir John Tenniel. Its absurd situations, droll humor and mad nonsensicality have endeared the story of Alice to readers of all ages, and some of its incidents and phrases are as well known as any in literature. The next popular book by the elusive "Lewis Carroll" was *Through the Looking Glass*, 1871, a sequel to Alice, and acclaimed by many as its equal; the two stories were dramatized in 1886 by Saville Clarke. *The Hunting of the Snark*, 1876, a nonsense tale in verse, was well received, and was followed by the less successful *Rhyme and Reason*, 1883, *Sylvie and Bruno*, 1889, and *Sylvie and Bruno Concluded*, 1893. Under his pseudonym Dodgson also wrote the humorous scientific books, *A Tangled Tale*, *Pillow Problems* and *A Game of Logic*. There are few authors whose works include a volume like *Euclid, Book V, Proved Algebraically* and such nonsense verses as "The Walrus and the Carpenter" and "You are old, Father William." Indeed, there has been only one "Lewis Carroll." He died at Guildford, Surrey, Jan. 14, 1898.

BIBLIOGRAPHY—S. D. Collingwood, *The Life and Letters of Lewis Carroll*, 1899; B. Moses, *Lewis Carroll*, 1910.

DODO (*Didus ineptus*), a stout, clumsy bird allied to the pigeons, formerly found in the island of Mauritius but now extinct. It was about as large



COURTESY AMER. MUS. OF NATL. HISTORY
DODO, FROM A RESTORATION

as a swan with short legs and rudimentary wings incapable of flight. The dodo laid a single egg in a nest on the ground. Vasco da Gama discovered the bird in 1497 and it was later extensively used for food by sailors of ships visiting the island. Within ten years after the colonization by the Dutch of Mauritius in 1644 the dodo was completely exterminated.

DODONA, an ancient city in Epirus, known in mythology as the seat of the oldest Greek oracle, dedicated to Zeus. It was said to have been founded by DEUCALION. The messages of the oracle were read from the rustling of leaves on an old oak tree or the murmur of the fountain or the clanging of cauldrons. The priestesses were called doves, *pelciades*.

DOG (*Canis familiaris*). The wolf was probably the first ancestor of the dog, and even to-day the two animals interbreed readily. Jackals and coyotes also have been tamed and are close relatives of some dog species. But there are also wild dogs much like certain domestic breeds. Nearest is the dingo or wild hunting dog of Australia, often tamed by the aborigines; it is related to a half-wild dog of Java and very like the pariah dog of India. The dhole of India resembles the hunting dog of Africa, both running in packs. There is also a wild bush dog of Guiana, not closely related to the true dogs.

But in general the modern dog, closest in affection to man of all animals, traces back to the very dawn of human life, being probably the first mammal tamed and having given its flesh for food, its hide for warmth and its scent and tracking ability as a hunting aid to man from prehistoric times. Dog skeletons taken from excavations closely resemble those of modern breeds, and the fact that dogs were buried with humans proves the close relation that existed even in times of primitive savagery. The enormous variation in type among dogs shows the adaptability of the group as a whole; by the various breeds one may trace man's changing ideals of canine usefulness. When man used his dog in the quest for food and to assist in guarding his rough abode, he needed speed, scent and strength. As man became more civilized, the dog learned to help herd and protect the flocks, and selectivity improved this characteristic. Gradually as living conditions changed man turned his hunting instincts into sport, and dogs first fought captive wild beasts, then were matched with each other. In some countries dogs developed size and sturdiness to carry man's burdens. Later, city life fostered the development of the toy dog and breeds encouraged for appearance. Thus an amazing number of breeds have been developed concurrently, and all have profited by deliberate attempts to improve the strain.

Nor is the domestication of the dog to be attributed to any one people, for so far as is known, every type of human savage has at some time trained or partially tamed some kind of dog. Remains of dogs are found from the kitchen middens of Denmark to the Lake Dweller excavations of Switzerland. The most ancient monuments in the valley of the Euphrates and Indus depict dogs very like our modern animals, while the Egyptians worshipped the dog as *Anubis*, the genius of the Nile, and the Ethiopians elected a dog as their king. Pythagoras, who taught that man's soul enters animals at death, preferred a dog to perpetuate human virtues. The Greeks and Romans prized dogs greatly, using them in the chase as well as for pets and watchdogs, while in Asia, where the animals as

a rule are not highly regarded, certain species were given royal honors. The American Indians had half-wild hunting dogs, tamed from coyote or wolf stock, and until the coming of the white man, regarded dogflesh as an excellent food. The sacrifice of a white dog to the moon witch Atensic was a rite of the False Faces, the secret society of the Iroquois.

Two definite physical characteristics distinguish the modern dog from the wolf. The wolf howls, but does not bark; the pupils of all dogs' eyes are circular, those of wolves oblique. The latter is unchanging, but a few dogs, as the Eskimo, howl much like a wolf. The first classification of dogs was based on physical structure, three main groups being designated. The first included dogs with elongated heads, such as greyhounds; the second, those with heads moderately elongated and with the parietal bones somewhat divergent, such as spaniels; the third, dogs with short muzzles and enlarged frontal sinuses, such as terriers. The difficulty of classifying some of the intermediate breeds led later to a new arrangement, based on the activity of the dogs, with six classes: (1) Dogs that hunt for man, but without killing, as setters. (2) Dogs which kill game started for them, as greyhounds, which have little scent but keen sight. (3) Dogs which start and kill their prey, as otterhounds. (4) Dogs which retrieve game for man. (5) Dogs with a definite use to man, as St. Bernards. (6) Toy dogs, such as the pug. This classification, proposed by J. H. Walsh of Great Britain, was superseded in 1900 by a British exhibitors' agreement dividing dogs into sporting and non-sporting groups. Later toys were made a sub-division. In 1929, the official publication of the American Kennel Club, *Pure Bred Dogs*, listed six classes. While these groups refer only to dogs bred or exhibited for show purposes, it is said that almost every known breed is included.

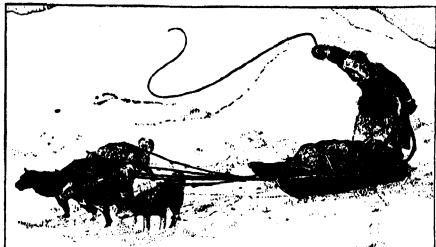
Group I. Sporting dogs: Chesapeake Bays, Griffons (wire-haired pointing), Pointers, Curly-Coated, Flat-Coated, Golden and Labrador Retrievers; English, Gordon and Irish Setters; Clumber, Cocker, English Springer, Field, Irish Water, Sussex and Welsh Springer Spaniels.

Group II. Sporting dogs (Hounds): Afghan Hounds, Basset Hounds, Beagles, Bloodhounds, Dachshunds, Scottish Deerhounds, American and English Foxhounds, Greyhounds, Harriers, Norwegian Elkhounds, Otterhounds, Salukis, Whippets, Irish and Russian Wolfhounds.

Group III. Working dogs: Belgian Sheepdogs, Bouvier des Flandres, Briards, Rough and Smooth Collies, Eskimos, Great Danes, Mastiffs, Newfoundland, Old English Sheepdogs, Doberman Pinschers, Samoyedes, Giant Schnauzers, Shepherd Dogs, Shetland Sheepdogs, St. Bernards.

Group IV. Terriers: Airedales, Bedlington Terriers, Border Terriers, Bullterriers, Cairn, Dandie Dinmont, Smooth and Wire Foxterriers, Irish, Kerry Blue and Manchester Terriers, Miniature Pinschers, Schnauzers, Miniature Schnauzers, Scottish, Sealyham, Skye, Welsh and West Highland White Terriers.

Group V. Toys: Chihuahuas, English Toy Spaniel, Brussels Griffons, Italian Greyhounds, Japanese Spaniels, Maltese, Mexican Hairless, Papillons, Pekinese, Pomeranians, Pugs, Toy Black and Tan Terriers, Toy Poodles, Yorkshire Terriers.



COURTESY AMER. MUS. OF NATL. HISTORY

LEDGE DRAWN BY ESKIMO DOGS

Group VI. Non-Sporting: Boston Terriers, Boxers, Bulldogs, Chows, Dalmatians, French Bulldogs, Poodles, Schipperkes.

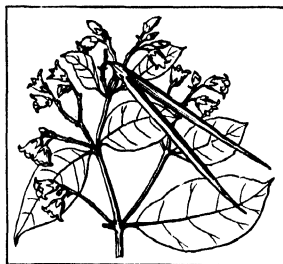
The extremes to which breeding has brought this most variable of animals is illustrated by comparing such dogs as the Great Dane and the pug, the St. Bernard and the griffon. It is equally interesting to contrast the influence of breeding for utility upon related dogs. The surly, half-wild Eskimo, able to eat the coarsest food and to endure terrific hardship, is closely related to the toy Pomeranian, a delicate housedog completely dependent upon man. The poodle is derived from the same stock as the hunting spaniel, while the Newfoundland is only a gigantic spaniel. The pugdog is a mastiff, deliberately dwarfed. The Pekinese, a toy in this country, is a much-respected watchdog in the Orient; the Chow, also a native of China, is an aristocrat among pets, but his Manchurian brother is not only a watchdog and beast of burden but is eaten as food, while furriers know its black skin as Manchurian wolf.

The Belgian cart-dog, the highly trained police dogs, allies of law and order in Germany, the sled-dogs of the north, the St. Bernard of the Alps, the dogs that pulled machine guns in the World War and carried messages and first aid kits, are all examples of canine service to man. Dogs stand with cats as destroyers of vermin, many of the finest breeds being ratcatchers of note, and not unwilling to tackle other animal enemies larger than themselves. Two breeds "made" for desirable qualities are the Airedale, a cross of the otterhound (a courageous and keen-scented but somewhat surly dog), and the old black and tan, and the wire-haired terrier. The Boston terrier is a cross of the English bulldog, which traces back to the Roman era, and the English terrier, and originally came to America as ratcatchers on vessels.

Requirements for the different breeds are obtainable from associations formed to standardize the desirable points of each, and these organizations can advise on care and training. In general, any dog re-

sponds to proper care, the dog with poor manners reflecting discredit more on his owner than on himself. A dog should be kept clean and well-groomed, a little daily attention being better than occasional violent grooming. He should eat regularly, not too heavily and have a varied diet, and should have regular exercise. When a dog is ailing, his condition should be professionally diagnosed, as taking ignorant advice has often resulted in harm.

DOGBANE, a genus (*Apocynum*) of plants with an acrid milky juice, typical of the dogbane family (*Apocynaceae*). There are about 25 species native to north temperate regions. They are perennial herbs



AMERICAN OR SPREADING DOGBANE

usually with branching stems, opposite, entire leaves, and small white or pink flowers, mostly in terminal clusters. The characteristic fruit consists of long slender pods (follicles) borne in pairs and containing numerous small downy-tufted seeds. Representative North American species are the spreading dogbane (*A. androsaemifolium*), an elegant woodland species with dainty pink flowers, and the so-called Indian hemp (*A. cannabinum*), with greenish flowers, both found across the continent.

DOG FENNEL (*Anthemis cotula*), an ill-scented annual herb of the composite family closely allied to chamomile, called also mayweed. It is a native of Europe which has become very widely naturalized as a weed in the United States and Canada and other parts of the world. The plant grows usually from 1 to 2 ft. high, bearing smooth, very finely divided leaves and showy flower-heads about an inch across, composed of white rays surrounding a yellow disk.

DOG-FISH, the name of several sharks known for their destruction of fishermen's hooks and nets and their habit of preying on schools of herring and mackerel in dog-like packs. They inhabit cool and semi-tropical waters and are found on both coasts of the Atlantic and Pacific. Dog-fish are generally characterized by rounded, tapering bodies. The mouth, on the ventral side, below the end of the snout, is equipped with sharp teeth, useful for cutting. Full grown fish are from 2 to 4 ft. long and weigh from 8 to 12 lbs. The spiny dog-fish (*Squalus acanthias*), an ovoviviparous species, has a spine before both dorsal fins. Its chief commercial value is in the oil extracted from the liver, used in adulterating

better oils. The flesh is sometimes used as a fertilizer. Smooth dog-fish (*Cynias canis*) lack the dorsal spines. They feed mainly on crabs. In England and some parts of Europe the flesh is dried and eaten.

DOGGER BANK ARBITRATION, THE, ended a crisis which arose between Great Britain and Russia during the Russo-Japanese War. Dogger Bank is an extensive shoal in the North Sea between England and Denmark, famous as a fishing ground. The Hull trawling fleet was fishing there Oct. 21, 1904, when it was fired upon, apparently in a fear-born panic, by Russian warships on their way to the Far East. Two men were killed and several boats sunk or injured. Friction developed and war threatened between Britain and Russia; but the matter was referred to an international commission of arbitration which, reporting Feb. 25, 1905, decided against the Russian Government and ordered it to pay compensation to the families of the victims.

DOGGEREL, originally burlesque poetry, especially that which had irregular meter; more recently, any verse of irregular meter and uneven lines held together by rhyme tags. Doggerel derives mainly from the racy verse of JOHN SKELTON and was at first a vehicle for satirical comment on life.

DOGRIB, or Thlingchadinne, an American Indian tribe, belonging to the northern division of the Athapascan linguistic stock. Early in the 19th century they lived north and northeast of Great Bear Lake, with Great Slave Lake as the southern limit of their territory, though prior to that time they had been reported somewhat to the east of this district. Culturally they are not well known, but it is assumed that they partook of the general characteristics of other tribes of the Mackenzie area and were hunters and trappers.

DOGTOOTH VIOLET (*Erythronium dens-canis*), a small, bulbous, early-blooming plant of the lily family native to Europe and Asia and more or less



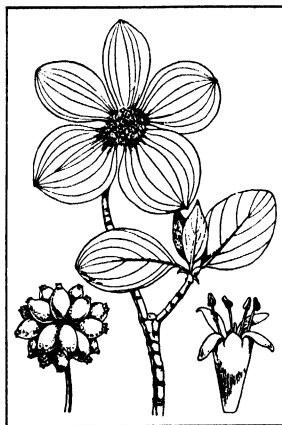
DOGTOOTH VIOLET

grown in borders and rockeries. It bears two root leaves, mottled with brown, and a single, drooping, long-stalked, rose-colored or purple flower. Various related North American species are often called dogtooth violet. See also ADDER'S-TONGUE.

DOGWOOD, the common name given to a genus (*Cornus*) of shrubs and small trees of the dogwood family. There are about 40 species, natives of north temperate regions, some 20

of which occur in North America, chiefly east of the Rocky Mountains. Many of these are cultivated for their ornamental foliage, handsome flowers or fruits, or for their brightly colored branches, which are very attractive in winter. The most showy American

species are the flowering dogwood (*C. florida*), of the eastern and southern states and the very similar western dogwood (*C. Nuttallii*), of the Pacific coast. The former is often cultivated for its beautiful, white or



HOW JEPSON. MAN. FL. PLANTS CALIF.. COPYRIGHT

WESTERN OR MOUNTAIN DOGWOOD
Fruit cluster, flowering branchlet and single flower

rose-red flower-heads, 3 to 4 in. across. It is prized also for its hard, close-grained wood valued in turnery.

DOIRAN, a lake of Macedonia about 40 mi. northwest of Salonika. The boundary line between Greece and Yugoslavia passes through the middle of the



FLOWERING DOGWOOD

lake, leaving the town of Doiran, pop. about 8,000, in Yugoslav territory. The lake is circular in shape and abounds in trout. It is chiefly known for the Battle of Doiran, which occurred in 1917 when the British met the Bulgarian forces on the shores of the lake. Monuments to commemorate the battle have been erected by the British.

DOLAN, JAMES H. (1885-), American educator, was born at Boston, Mass., June 4, 1885. He was educated at Boston College; Saint Andrews-on-Hudson, New York, and Woodstock College, Maryland; and was ordained a priest in the Roman Catho-

lic Church. From 1912-17 he taught classics at Georgetown University. He was professor of philosophy at Holy Cross College, 1922-25, and became president of Boston College in 1925. His publications include *Fundamental Psychology*, *Advanced Psychology* and *Natural Theology*.

DOLBEAR, AMOS EMERSON (1837-1910), American inventor, was born at Norwich, Conn., Nov. 5, 1837. He studied at Ohio Wesleyan, and occupied the chair of physics at Tufts College, Medford, Mass. His genius found expression in several important researches and inventions. In 1873 he demonstrated the convertibility of sound into electricity. Other researches were related to the writing telegraph, the electric gyroscope, the static telephone, wireless telegraphy and photography with electric waves. Among his best-known works are *The Art of Projecting Matter, Ether and Motion* and *The Machinery of the Universe*. He died Feb. 23, 1910.

DOLCI, CARLO or **CARLINO** (1616-86), Italian painter of sacred subjects, was born at Florence, May 25, 1616. His canvases, which are few in number and usually small in size, are typical of the excessive sentimentality popular at the time. His virgins and saints, of which the *St. Cecilia* at Dresden is the most frequently reproduced, were formerly much admired because of their delicacy of composition, daintiness of color and clever chiaroscuro. Dolci's quiet life was spent largely in Florence, where he died, Jan. 17, 1686.

DOLDRUMS, areas in the equatorial zone of the oceans on earth where there is little or no wind. Lying between the belts where the TRADE WINDS are blowing, the doldrums change their position with the seasonal variation in the former, though never more than 15° distant from the equator. As there is practically no horizontal motion of air, the weather in these areas is oppressive and of extreme humidity, thunderstorms and heavy rainfall being frequent. Before the days of steam navigation sailing vessels were often caught for weeks at a time in these calms. From the depressing and generally adverse psychological effect it had on the crew originated the expression of "being in the doldrums."

DOLE, SANFORD BALLARD (1844-1926), Hawaiian public official, was born in Honolulu, Apr. 28, 1844. He studied law in Boston and practiced in Honolulu where he entered politics and in 1893-1900 was head of the provisional government. He was a leader in the movement to secure annexation of the islands by the United States, and after this was effected in 1900 he was appointed governor of the Territory. He resigned in 1903 to become U.S. District Judge of Hawaii. He retired in 1915, and died at Honolulu, June 9, 1926.

DOLERITE, a name applied loosely to certain IGNEOUS ROCKS of the basalt-gabbro group. In America the tendency is to restrict it to the BASALT porphyries. Dolerite is dark colored, as the darker silicates, AUGITE, OLIVINE and, rarely, HORNBLende, predominate over the lighter PLAGIOCLASE feldspars

of the labradorite-anorthite series. Phenocrysts in dolerite are usually augite or olivine. *See also* BASALT; GABBRO; PORPHYRY; PETROLOGY.

DOLLAR, the monetary unit of the United States, Canada, Newfoundland, British Honduras, Dominican Republic, Liberia and Straits Settlement. The United States equivalent of the dollar is 100 United States cents except for the Straits Settlement dollar, the par value of which is 56.78 cents. The United States dollar is patterned after the Spanish dollar or piece-of-eight, and contains 26.73 grams of .900 fine silver. The gold dollar, which is the standard, coined by the United States during the period 1849-90 contained 25.8 grains of gold, .900 fine.

DOLLAR DIPLOMACY, a phrase identified with the avowed policy of Secretary of State, 1909-1913, PHILANDER C. KNOX, of shaping the foreign policy of the United States, particularly as affecting Latin America and the Orient, for the protection and advantage of investments of American capitalists.

DOLLAR EXCHANGE, drafts drawn payable in United States dollars and used in the settlement of transactions between a buyer and a seller in two foreign countries. Many factors contribute to the desirability of any exchange medium, but of almost controlling importance is the maintenance of a discount market capable of absorbing, at rates lower than any other international financial center, all the bills offered. Until the passage of the FEDERAL RESERVE ACT in 1913, national banks in this country did not possess the power to accept time drafts, and there was, consequently, no available supply of bills and naturally no DISCOUNT market. Federal Reserve banks possess the power to accept drafts, having not more than six months sight to run, which grow out of transactions involving the importation, exportation or domestic shipment of goods, or which are secured by readily marketable staples stored in independent warehouses. The act also provides for the creation of an adequate supply of dollar exchange in countries where the seasonal nature of crop movement, irregularity of mails or other causes result at times in a scarcity of commercial bills, by permitting member banks to accept 90-day drafts drawn solely for the purpose of creating dollar exchange by banks or bankers in countries designated by the Federal Reserve Board as requiring this facility. With an ample supply of dollar exchange bills thus secured, there has grown up in New York a discount market in which dollar exchange is traded in at as high rates and as freely as sterling bills are dealt with in London; and the draft drawn in United States dollars has become an acceptable medium of settlement of international indebtedness. W. W.

DOLLAR STABILIZATION. *See* STABILIZATION.

DÖLLINGER, JOHANN JOSEPH IGNATZ (1799-1890), German church historian and theologian, was born at Bamberg, Feb. 28, 1799. He prepared for the priesthood at Würzburg, where his father was professor of anatomy and physiology, and was ordained in 1822. After teaching a year at Aschaff-
enburg

burg, he commenced his career of historian, publicist and theologian, as professor of theology and jurisprudence at the University of Munich. His early works expressed strong antagonism to Protestantism but later he changed to a more liberal attitude and finally became an active anti-ultramontane and anti-Jesuit, and opposed the doctrines of the immaculate conception and the infallibility of the pope. He was a prolific writer of church history and of great influence as publicist until his death, in Munich, Jan. 14, 1890.

DOLLIVER, JONATHAN PRENTISS (1858-1910), American political leader, was born near Kingwood, W.Va., Feb. 6, 1858. He graduated in 1875 at West Virginia University, then studied law, and in 1878 was admitted to the bar. While practicing law at Ft. Dodge, Ia., he was elected to Congress in 1889, serving until 1901, when he became a United States Senator. With LaFollette and others he was a leader of the insurgent Republican group in opposing any increase in tariff duties, during Roosevelt's administration, and was prominent in fighting the Payne-Aldrich bill in 1909-10. He died at Ft. Dodge, Oct. 15, 1910.

DOLLOND, JOHN (1706-1761), English optician, was born in London, June 10, 1706. Until 1752, he worked as a silk weaver at Spitalfields. Educating himself in astronomy, optics, and mathematics, however, he devoted himself to the perfection of the telescope. In 1758 he discovered the principles underlying the scattering of color rays when light passes through a lens. From this discovery, in association with his son, he developed a method of fitting concave and convex lenses of flint and crown glass to eliminate this scattering and to transmit images without the development of color borders, i.e., in modern terminology, achromatic lenses. He died in London, Nov. 30, 1761.

DOLL'S-EYES, a name sometimes given to the white BANEERRY because of the eyelike appearance of the polished, beadlike berries which are marked with a purplish spot at the end.

DOLOMITE, called also magnesian spar and magnesian limestone, a mineral closely allied to CALCITE, which it resembles. It is white to pink, yellow, brown, gray, and when pure is translucent. Dolomite is the carbonate of calcium and magnesium, intermediate between calcite and MAGNESITE. Like them it crystallizes in the rhombohedral division of the HEXAGONAL SYSTEM, but the crystals are usually warped. It is found crystalline, and in fine granular or compact masses, frequently with calcite to form LIMESTONE. Rock largely dolomite is called dolomitic limestone.

Epsom salts are made from the mineral dolomite, and dolomitic limestone has much the same uses as ordinary limestone except where pure calcite is required for chemical purposes. Dolomite was named after Dolomieu, an early French geologist. See also SAND; SEDIMENTARY ROCKS; PETROLOGY.

DOLOMITES, a chain of mountains which are a subdivision of the Eastern ALPS chiefly confined be-

tween the valleys of the Piave, Drave and Adige. These mountains are of limestone formation and rise sharply into magnificent heights, between which lie deep valleys. The highest peak, rising 10,972 ft. above sea level, is the Marmolata. Other well-known summits of almost equal heights are the Sorapis and Langkofel. The Dolomites were ascended in the '60s and '70s by British mountaineers.

DOLORES RIVER, a tributary of the Colorado, rising in the La Plata and San Miguel mountains in southwestern Colorado. It runs southwestward for 50 mi., north for 100 mi., then changes its course to west. It crosses the western boundary of Colorado into Utah and discharges into the Colorado in Grand Co. The greater part of its course of 250 mi. runs through deep canyons, making the river inaccessible for commercial use although it has a few irrigation developments. By a great tunnel and cut in the Montezuma valley the waters of the Dolores are diverted to irrigate the San Juan basin. Its drainage area is 4,500 sq. mi.

DOLPHIN, the most graceful, swift, and sportive of small sea-mammals, numerous in warm and cold waters the world over. The common dolphin (*Delphinus delphis*) is about 6 to 7 ft. long. It has a slender, cigar-shaped body, black above, white beneath, which it arches conspicuously in diving; long, pointed flippers, a small head, and a narrow 6 in. beak armed with many keen teeth. Schools of shining dolphins delight to accompany race ocean liners, curveting about the prow, or breaking through waves with the rush of living torpedoes. They are very destructive to mackerel fisheries. Owing to their fabled friendship for man, dolphins figure prominently in art and heraldry. The dolphin is popularly confused with an allied, but very different cetacean, the heavy, blunt-headed porpoise dubbed "the pig of the sea."

DOMBEY AND SON, a novel designed to anatomize pride, by CHARLES DICKENS; published 1848. This is the story of Mr. Dombey, of Dombey and Son, whose enormous pride is brought low at last by a financial disaster. One of the most notable episodes in the book is that of the invalid life and death of Paul, the proud man's son. Among the more memorable minor characters are the Toodles family, Mrs. Pipchin, James Carker, Captain Cuttle, Mrs. MacStinger, Miss Tox and Mr. Toots.

DOME, strictly, a hemispherical or ovoidal vault; more generally any vault which rises uniformly and without breaks from a polygonal plan; also, any structure, however built, having the general form of a true dome. The dome shape occurs naturally in the building of primitive, circular huts; and the transition from a roof of boughs and twigs, or skins, to one of sun-dried brick or small stones set in mud, or in the case of the Esquimaux blocks of ice, seems to have been made at a prehistoric date, at least in western Central Asia. Thus high, ovoidal domes are represented in Assyrian reliefs of the 8th and 9th centuries B.C. as common features in the village silhouette. The



THE DOMBEY FAMILY

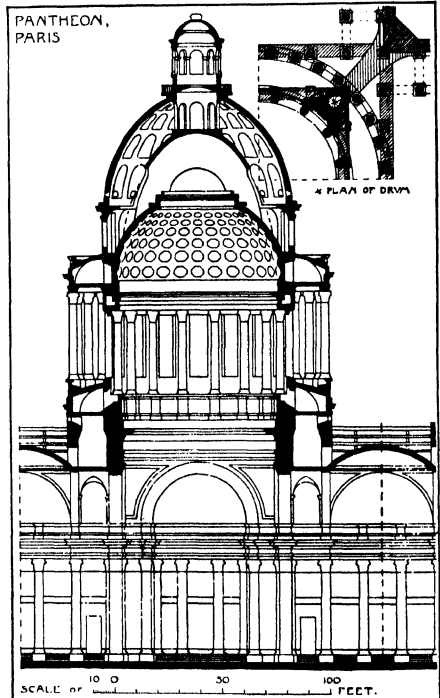
Drawing by "Phiz" (H. K. Browne) for Dickens's *"Dombey and Son"*

so-called beehive tombs of Aegean architecture, perhaps themselves reminiscent of hut forms, employed the dome form built with horizontal, corbeled courses; and, although the result is not a true vault, the forms thus developed undoubtedly had an influence in the later perfection of the type.

The Romans during the Imperial Period were the first people to appreciate the enormous architectural possibilities of the monumental dome. Adopting the form from the Etruscans, who had used it tentatively in tomb building, by the time of Hadrian they had developed it into a major element in their architecture. The Pantheon, Rome, about 125 A.D. is the largest, 144 feet in diameter; but the Villa of Hadrian contains other remarkable examples of the same date. In these Roman domes, the material is either brick or concrete, principally the former, often stiffened by ribs or built-in discharging arches. Scalloped forms are common, as in the Nymphaeum of the Gardens of Sallust, about 80 A.D., and the magnificent so-called Temple of Minerva Medica, really the Nymphaeum of the Licinian Gardens, built in the middle of the 3rd century, which is one of the most scientific of Roman constructions, as well as the lightest and most delicate. The form was also common in Roman tombs. The Romans experimented with the idea of putting a dome on a building of square or polygonal plan, by means of diagonal arches or corbels in the corners, but never achieved a complete solution of this problem.

It was probably in Syria and nearby countries that the true spherical pendentive was first invented, and at once allowed a freedom in the use of domes before unknown. This discovery was at the basis of much

BYZANTINE ARCHITECTURE; the 6th century Santa Sophia, in Constantinople, with its dome 100 feet in span, on four tremendous pendentives and pierced with 40 windows in a ring at its base, was the inspiration of hundreds of domes in the following centuries. The later Byzantine domes are smaller in span, but set at a greater relative height; and the windows, instead of being in the dome itself, are in a high cylindrical wall known as a drum, between the top of the pendentives and the dome. Important offshoots of the Byzantine style are to be found in all the Mohammedan styles, and also in an interesting group of French Romanesque churches of the late 11th and early 12 centuries, in Aquitaine: the Cathedral of Cahors, and the Church of St. Front at Perigueux,



F. M. SIMPSON. A HISTORY OF ARCHITECTURAL DEVELOPMENT. LONGMANS, GREEN

CROSS SECTION OF THE TRIPLE-SHELL DOME OF THE
PANTHÉON, PARIS

whose plan is structurally identical with that of the Byzantine Church of St. Mark's in Venice. Mohammedan domes are possibly based, not only on the Byzantine precedent, but also upon a native dome-building tradition in Persia. Many churches in Armenia, from the 7th to the 11th centuries, with beautiful cut-stone domes, stand in an uncertain relationship to the Byzantine and Mohammedan traditions.

The Moorish countries generally used many domes of small scale; but the later Mohammedan styles of Egypt and Mesopotamia, and those of Persia, Turkey

and India, used domes magnificently conceived, of large size and often dominating position.

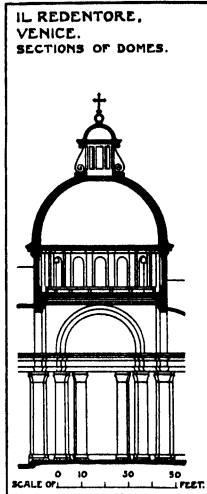
The Renaissance architects of Europe found in the dome a congenial form susceptible of a great development, and usually combined it with a high drum and the Byzantine pendentives. Frequently, in order to obtain commanding exterior effect, with a pleasantly proportioned interior, two separate shells of different heights were necessary. Sometimes a third shell, between the upper and the lower, was inserted in order to carry the weight of a decorative lantern or cupola, and also by its weight to reduce the thrust of the inner dome. Many of the Renaissance domes, however, had chains of metal, or wood and metal, built in at their base

in order to prevent the thrust forcing an outward collapse. Of the great Renaissance domes, those of the Cathedral in Florence, begun about 1418 by Brunel-

and St. Paul's, London, begun 1675, by Sir Christopher Wren, have three shells, of which the outer one is of timber; and that of the Panthéon, Paris, 1764-90, by Soufflot, has three, all of stone.

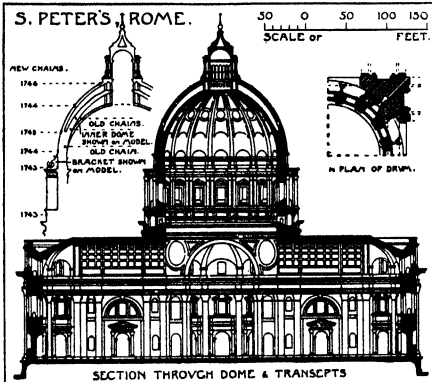
T. F. H.

See Strzygowski, *Origins of Christian Church Art*.



FROM F. M. SIMPSON, A HISTORY OF ARCHITECTURAL DEVELOPMENT. LONGMANS, GREEN & CO.

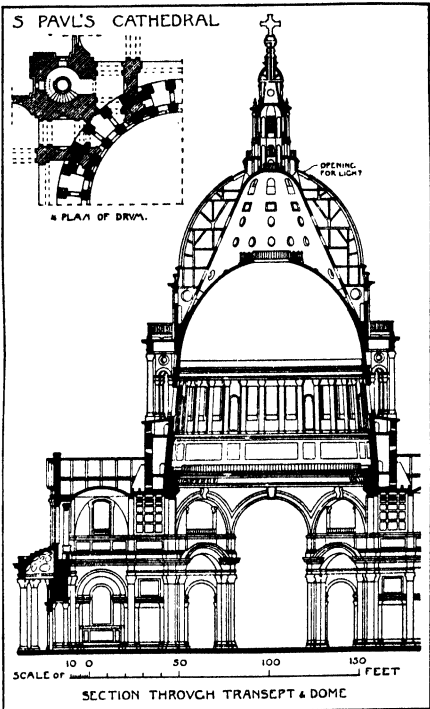
CHURCH OF IL REDENTORE, VENICE



FROM F. M. SIMPSON, A HISTORY OF ARCHITECTURAL DEVELOPMENT. LONGMANS, GREEN & CO.

A DOUBLE-SHELL DOME

leschi, and of St. Peter's in Rome, built 1588-89 by della Porta and Fontana from earlier designs by Michelangelo, have two shells, both of masonry; that of the Invalides, Paris, 1675-1706, by J. H. Mansart,



FROM F. M. SIMPSON, A HISTORY OF ARCHITECTURAL DEVELOPMENT. LONGMANS, GREEN & CO.

TRIPLE-SHELL DOME OF ST. PAUL'S CATHEDRAL, LONDON

DOMENICHINO, ZAMPIERI (1581-1641), Italian painter, was born at Bologna, Oct. 21, 1581. He studied under Agostino and Annibale Carracci. At Rome he executed frescoes for various cardinals and designed the Villa di Belvedere at Frascati for Pope Gregory XV. His painting of *The Communion of St. Jerome*, in the Vatican Gallery, was at one time considered one of the greatest pictures in the world. Domenichino spent his last years at Naples, where he opened a school. His works, of which the *Adam and Eve* and the *Martyrdom of St. Agnes* at Bologna are typical, are well executed but entirely uninspired. The painter died at Naples, Apr. 15, 1641.

DOMESDAY BOOK. A systematic survey of England was ordered by William the Conqueror (see WILLIAM I), in 1085, the results of which have been preserved in two thick manuscript tomes, the Domesday Book, containing a priceless record of the social

conditions of the time. The object of the survey was to determine the amount of taxable property in the country south of the Tees and so to enable William to compute the service due the king. Groups of officials were sent to every corner of the land who obtained sworn statements as to who the landholders were, the value of their estates, the number of their tenants and the amount of tax they paid when a DANEGELD was declared.

The Anglo-Saxon Chronicle of that year reports: "So very narrowly did he cause the survey to be made that there was not a single hide nor a rood of land, nor . . . was there an ox or a cow, or a pig passed by, that was not set down in the accounts." The commissioners went from hundred to hundred in each shire and summoned the inhabitants to give this detailed information. The records were then sent to Winchester and after rearrangement were recopied into the manuscripts mentioned above. The *Domesday Book* is now on public view at the Public Record Office in London. It is important to remember that the counties of Northumberland, Cumberland, Westmorland and Durham were not included in the survey. Of primary significance, too, is the fact that the census could be taken at all with such a mass of details. It indicates that the authority of William the Conqueror was practically unquestioned.

DOMESTIC ANIMALS. What wild ancestor of modern animals first fraternized with primitive man is not known, but the act paved the way to a more stable human existence. A single captive animal might supply food for a few days, but when that animal produced offspring, the way was opened for an endless future supply. Together with plant cultivation, the domestication of animals made possible fixed habitations and property ownership.

A domestic animal is therefore not a tamed wild animal, but one which from its first days knows a certain dependence on man, and which breeds freely in captivity. The animal may revert quickly to the wild state, as do horses or goats. It may, like the chicken, lack the ability to take care of itself when abandoned. It may be profoundly altered by breeding, as is the domestic pig, or it may remain unchanged in appearance and disposition, like the camel or water buffalo.

Few of the known species of the world have yielded permanently to domestication. Of 3,300 living mammals, 23 are domesticated; 12 of the thousands of species of birds, 2 fishes and 3 insects. Of this group, almost all come originally from the Old World. Practically all of importance were first domesticated in Asia, many before history began. Among these are the bactrian camel, the horse, the pig, probably sheep, and the banteng, humped cattle, gaur, gayal and water buffalo. The ass probably originated in the valley of the Nile; the cat, domesticated when history began, was sacred in Egypt. The dog was probably the first animal to associate with primitive man.

Other species dating to prehistoric or earliest recorded time include the bee, found when history be-

gan in the Mediterranean regions; the silkworm, first cultivated in China; the reindeer of the north; the goat and the goose. The elephant, tamed for countless generations in Asia and Africa, although docile under man's dominion, has never been domesticated to the point of breeding freely in captivity. India probably first domesticated the fowl and Tibet the yak. The mule, the only economically useful hybrid, is mentioned by Homer. Rabbits were introduced to the Romans by the Iberian peoples. The New World contributed the alpaca, domesticated by Peruvian Indians, the llama, the guinea pig, the cochineal insect and the turkey. Australia had no indigenous domestic animal.

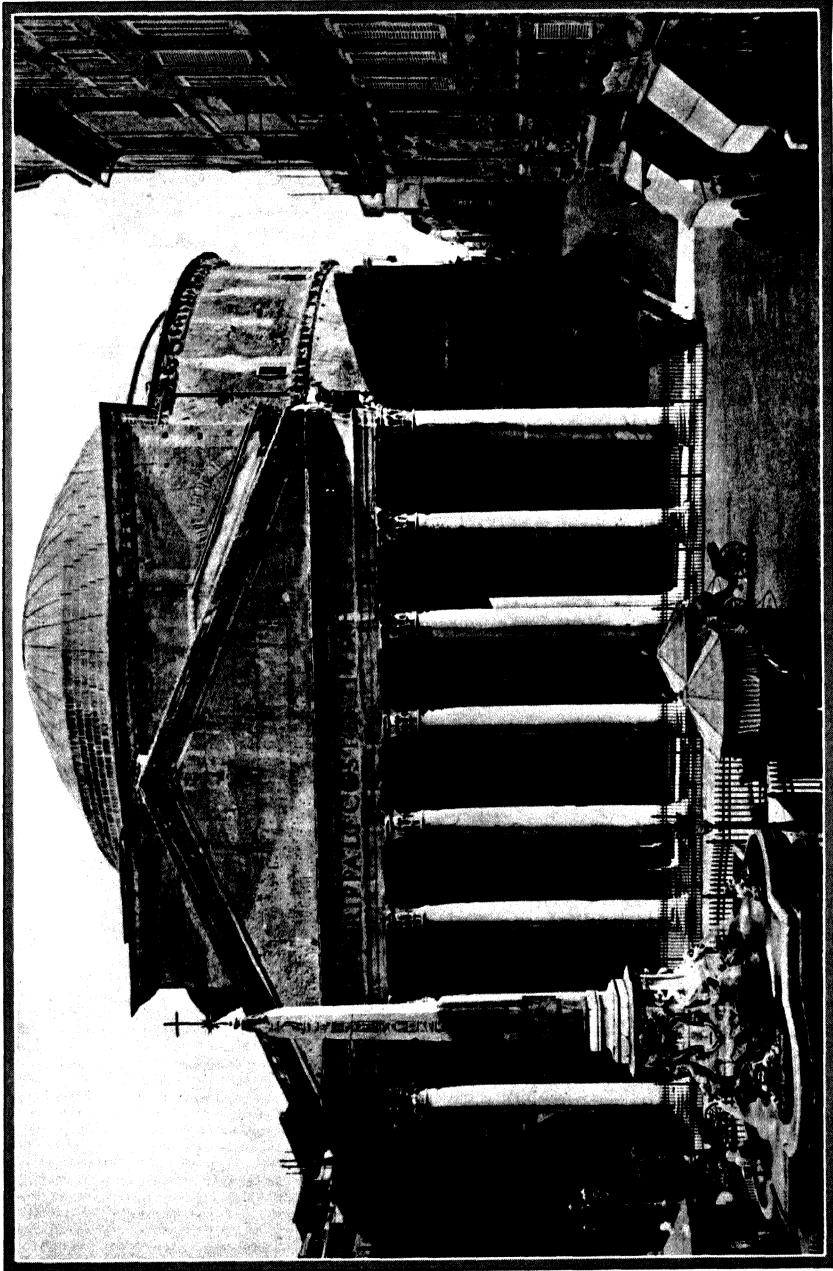
Man has used domestic animals as food supply, as beasts of burden, as aids in hunting and as pets. The sheep, used for food, is the leading fiber-producing animal of the world. The dog has always hunted with man, drawn his burdens and at times furnished food. The camel's hair is prized as well as its strength. Even the cat has earned its keep by destroying vermin. The falcon and the cheetah, beside the dog, are still used in hunting. The goldfish, canary, swan and peacock are purely ornamental.

To the list of true domestic animals no new species has been added in hundreds of years, and it seems doubtful if more ever will join those now known throughout the world.

DOMESTIC RELATIONS, a term applying to the various relationships involved in the household or family, husband and wife, parent and child, guardian and ward, and infancy. Marriage which is at the basis of the family, is (in Christian countries) the status of one man and one woman which arises from a civil contract between them whereby they mutually agree to discharge toward society and one another those duties which the law imposes upon the status. Founded in contract, it must satisfy the essentials of capacity of the parties, real consent and solemnization (generally fixed by STATUTE); because it results in status, it is indissoluble except by death or the state (annulment or DIVORCE). The mutual rights, duties and obligations of husband and wife as to support, service and earnings of wife, property and contracts, that are based upon the COMMON LAW conception that husband and wife are one and the husband is that one, have in modern times greatly yielded to the movement for giving the wife equal rights in all respects with the husband. Under the better view the rights and obligations of parent to child are reciprocal, the parent having the duty to support and educate, and the right to custody and control of the child and to his services and earnings. The care and management of the person and property of a minor may be vested by law in a GUARDIAN. The law of infancy deals with the condition of minors, their control and protection, their privileges and disabilities (removed by emancipation through marriage or court order) in regard to contracts, torts, crimes, ownership of property, and as litigants. N. G.

DOMESTIC SCIENCE. See HOME ECONOMICS.

DOME



THE CIRCULAR DOMED PANTHEON, ROME

This, the greatest of Roman domes, 144 ft. in diameter, covers the temple dedicated to all the gods, which was built by Hadrian about 115 A.D. The portico entablature incorporates an inscription taken from an older temple built by Agrippa.

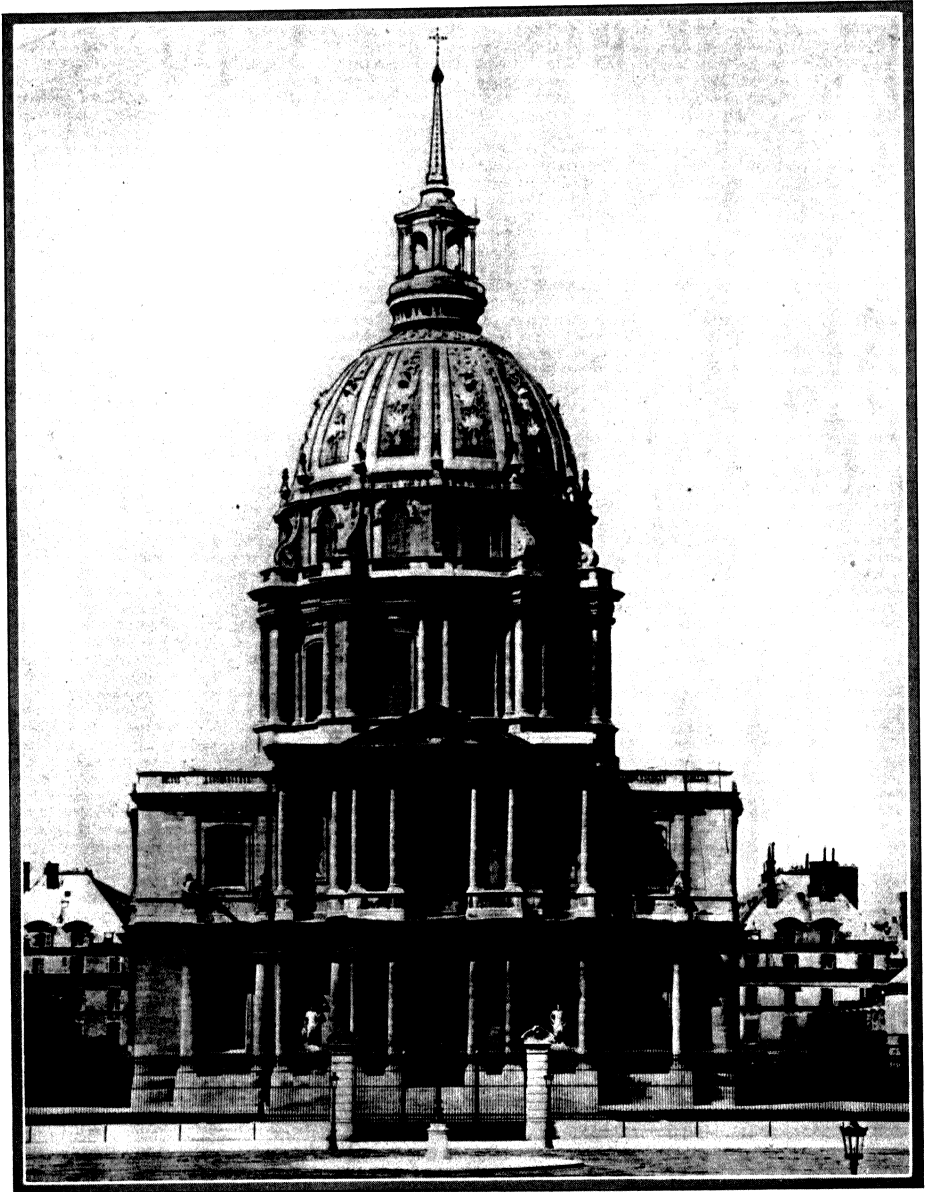
DOME



DOME OF ST. PETER'S CHURCH, ROME

This magnificent dome exemplifies the architecture of the Italian Renaissance. Designed by Michelangelo between 1546 and 1564, the original plans were carried out by Della Porta, 1588-90.

DOME



CHURCH OF THE INVALIDES, PARIS

The chapel dome, surmounted by a lantern and cross, rises to 350 ft. The chapel, one of the most perfect works of the Louis XIVth style, was designed by J.-H. Mansart in 1706 and now contains the tomb of Napoleon I.

DOMICILE, one's permanent home to which he intends returning when he goes away. A person may actually dwell in another place longer than he does in his domicile. For example, an actor may be on the road over a year, and still retain his accustomed domicile. Soldiers and sailors have this right as a matter of course. A person has the right to change his domicile at any time by actually taking up a new one with the intention of making it his permanent abiding place.

DOMINANT, in music, the fifth degree of any DIATONIC SCALE and the most important tone in that scale next to the tonic or keynote, which is the first degree; thus G is the dominant in the scale of C, being a fifth above it, D is the dominant in the scale of G, and so on.

DOMINIC, ST. (1170-1221), the founder of the Order of the DOMINICANS, was born at Calaroga, Old Castle, Spain, in 1170. After education in the University of Palencia, he became an Augustinian canon in the cathedral of Osma in 1194. In 1205 he went to Languedoc, where he engaged in an earnest preaching campaign against the ALBIGENSES. The work disappointed him, for the population remained unmoved. Although he is said to have served as inquisitor during the Albigensian War, there are Protestant historians who doubt it. His order, composed of the helpers who labored with him in Languedoc, was confirmed by Pope Honorius III in 1216. His last years were spent in establishing priories in Italy, France and Spain. He died at Bologna, Aug. 6, 1221, and was canonized in 1234 by Gregory IX.

DOMINICA, an island of the West Indies, belonging to the British group known as the LEEWARD ISLANDS. Dominica is the largest and most populous of this group. It has an area of 305 sq. mi.; its length is 29 mi. and its maximum breadth 16 mi. Thickly wooded ranges cut across Dominica from north to south. The rivers Layou and Pagoua have their courses through a level land lying between the ranges. The peaks of the ranges reach to a height of more than 5,000 ft. above sea level. Only a small part of the land is crop land, the surface being well timbered. Those sections which are under cultivation are very fertile, the products being oranges, limes, india-rubber trees and various tropical fruits. The exports include sugar, molasses, rum, coffee, cacao, bananas and oranges. Roseau, the capital of the island, and Portsmouth are the principal towns. Pop. 1931, 42,343.

DOMINICAN REPUBLIC, an independent state of the West Indies, comprising an area of 19,325 sq. mi. and embracing nearly two-thirds of the island of Santo Domingo or Haiti. It has a coast line of slightly less than 1,000 mi. and a frontier against the Republic of Haiti of 193 mi. The interior is broken up by valleys and four almost parallel mountain ranges, some of which reach to over 10,000 ft. above the sea. Mt. Tina, 10,300 ft., is the highest peak of Haiti and of the West Indies. The climate is tropical, but healthful, because of sea breezes and the altitude of the

interior. About one-half of the total area is cultivable and actually more than one-third of it is under cultivation. The remainder is covered with valuable timber, mostly pine. Cabinet and dye woods, especially the pods of the divi-divi tree, valuable in tanning, are exported. Sugar and its derivative molasses are the chief products; the sugar industry is largely in the hands of Americans, Cubans and Italians. In 1928 a total of 350,000 metric tons of raw sugar were exported. The country also produces large quantities of cacao, tobacco, coffee and corn and is rich in mineral deposits and livestock, particularly goats; an average of 250,000 lbs. of goat skins a year are exported. Bananas and coconuts are among the exports. Coal, copper and gold are among the minerals obtained. In 1928 the total value of the exports was close to \$150,000,000 and of the imports about \$140,000,000.

SANTO DOMINGO, on the bank of the River Ozama, is the capital and largest city; in 1928 it had a population of about 45,000. Other chief ports are Monte Cristi, Puerto Plata, Barahona, Sanchez, San Pedro de Macoris and Azua. The population of the entire republic as given in the 1921 census was 897,405. The bulk of it is a mixture of European, Indian and African blood, but there are many Spaniards and some Turks and Syrians. Pop. 1930, 1,200,000.

History. Bartholomew Columbus, under instructions from his brother CHRISTOPHER COLUMBUS, who had discovered the island of Haiti on his first voyage, in 1496 founded a settlement at the mouth of the Ozama River. This town, called Santo Domingo, was the first permanent settlement by Europeans in the New World. Cultivation of sugar-cane was begun in 1506; the mines were also exploited, largely by forced labor of the natives and later of Negro slaves. Until 1697 the island was the Spanish province of Espanola; the portion west of the Despoblado was then ceded to France (*see* HAITI), and the remainder was ceded to France in 1795. Throughout the 18th century Santo Domingo, as the eastern portion came to be called, was of slight economic importance, in contrast with the wealthy plantation society of Saint-Dominique. The Negro revolutionists of Haiti extended their authority over the whole island, the capital city of the eastern part, Santo Domingo, being captured by L'Ouverture in 1801. Spain resumed control of Santo Domingo, however, in 1808.

On Nov. 30, 1821, the colony overthrew the Spanish authorities, and attempted to secure recognition as a province of the republic of Colombia. Before the weak state could secure outside support, a Haitian army had overrun the country; José Nunez de Caceres, president of Santo Domingo, surrendered his capital city to President Boyer of Haiti on Feb. 9, 1822. The oppressive rule gave rise to secret revolutionary organizations, whose work, after many disappointments, was accomplished when on Feb. 24, 1844 the Dominican Republic, under the leadership of Ramon Mella, proclaimed its independence. As its existence was made precarious by repeated Haitian invasions and domestic factional disputes, the republic invited

Spanish overlordship, and from Mar. 18, 1861, to May 1, 1865, was again a Spanish colony. Annexation by the United States was then sought but was balked by the United States Senate. A treaty with Haiti in 1874 removed the chief reason for seeking outside protection. The unscrupulous régime of Ulises Heureaux, 1882-89, however, left an enormous foreign debt. The United States undertook financial supervision of the republic in 1905 and maintained a military occupation from Nov. 1916 until Sept. 1924.

BIBLIOGRAPHY.—Samuel Hazard, *Santo Domingo Past and Present; With a Glance at Haiti*, 1873; Sumner Welles, *Nathaniel's Vineyard: the Dominican Republic, 1844-1924*, 1928.

DOMINICANS, officially known as *Frates Praedicatores* or the Order of Preaching Friars, members of a mendicant religious order founded by St. DOMINIC (1170-1221) in Languedoc in 1215 and confirmed by the pope the next year. The constitution of the order states, "Our order was instituted principally for preaching and for the salvation of souls," hence the emphasis which it has placed on pulpit work. The Dominicans adopted the Rule of St. Augustine, with additions taken from the statutes of the PREMONSTRATIENSIS. The chief articles of their vows stress study, fasting, silence, abstinence from meat, absolute poverty and the wearing of a habit of wool. The habit at first was a black cassock and rochet, but later a white habit, scapular and a long black mantle, which explains why they have been called "Black Friars." In 1217 St. Dominic sent out his companions from Prouille to preach and establish centers in France, Spain and Italy, and many noted churchmen and preachers became members of the order, including FRA ANGELICO, St. THOMAS AQUINAS, ALBERTUS MAGNUS and SAVONAROLA, as well as many afterwards canonized saints, popes and archbishops. Revolutions destroyed the work of the order in several European countries, but for the last century the activity of the Dominicans has increased, especially in Spain, Holland, the Philippines and the United States, so that to-day they have about 6,300 preachers in about 400 houses.

DOMINIONS, technically a term indicating a territory or people subject to the control of an imperial power. Of recent years, however, by virtue of British practice the term has come to denote a practically self-governing COLONY. Thus the Dominion of Canada, although in theory subject to the British Empire, is in reality a self-governing nation. Such pressure as is exerted might better be described as influence rather than control. The Governor-General is in large measure a figurehead save in so far as his personality rescues him from desuetude. Australia, South Africa and New Zealand occupy a similar status within the British Empire and India has received official assurances of ultimate attainment of the same privileged position. Thus, although the original meaning of the word dominion is synonymous with possession, the development and usage of the last 75 years have made its connotation quite distinct.

S. C. W.

DOMINOES, a game for two or more, involving the use of 28 oblong pieces, or dominoes, of ivory or bone marked with black dots, and often backed with ebony. All the pieces are blank on one side and on the other divided through the center by a line. One domino is blank on both sides of this line, and the rest are marked from double six to 6-1, double five to 5-1, continuously through all the numbers.

The draw game is the most common of several variations of dominoes. The pieces are turned face downwards on the table and shuffled. A number, usually seven, are drawn by each player and set on edge facing him to form his hand. The first player places a domino, preferably of high denomination, face upward on the table. His adversary must match it by a piece from his hand which has at one end the same number as one end of the piece previously played. That is, if the first domino played has six at one end and five at the other, any domino having either six or five may be played. Thus the game continues. If a player cannot match, he must draw on the stock until he gets the necessary domino. The winner is the first to dispose of all of his pieces. When this is impossible, the one whose hand adds to the smallest total wins. One hundred points ordinarily makes the game.

A variation is the block game, which requires the player to lose his chance of play if he cannot match. Matador and Muggins are other variations of the game.

DOMITIAN (TITUS FLAVIUS DOMITIANUS) (51-96 A.D.), Roman emperor, second son of Vespasian, was born at Rome. In 81 he succeeded his elder brother Titus, whom he is said to have poisoned. The early part of his reign was marked by good government; just laws were enacted, the greed of provincial governors was curbed. After some years, his rule took on a terrible aspect, throwing all Rome into a state of constant fear. Like Nero, Domitian was cruel, cowardly and suspicious; popular and distinguished men were ever in danger of arousing his insane jealousy. He banished all the philosophers, including Epictetus, from Rome, and put to death many wealthy citizens so that he could attach their property. His envy of Agricola's great victories in Britain, caused him to recall the general to Rome. Domitian's own military campaigns, particularly those against the Dacians, were highly unsuccessful, and he sought compensation for his wounded vanity by widespread persecution among his own subjects. Toward the end of his reign, he arrogantly assumed the titles of Lord and God, claiming Minerva as his mother. A group of conspirators, aided by Domitian's wife, assassinated him in his palace at Rome in 96 A.D.

DOMREMY-LA-PUCELLE, the village in north-eastern France, in the department of the Vosges, where JOAN OF ARC was born on Jan. 6, 1412. Her cottage birthplace is still standing and has been made into a museum. Where Joan first heard her "voices" a modern church has been erected. Pop. 1931, 266.

DON, an important river of southern Russia. The stream rises in Lake Iran, a small body of water in the heart of the Russian plain near Tula, and courses south through the fertile country of the Don Cossacks. It empties into the Sea of Azov, forming a wide delta at its several mouths. It is fed by many important tributaries; the Donetz, its largest affluent, the Khoper, the Medveditsa, the Manych, the Voronezh and the Sosna. In some places it attains a breadth of 18 mi. during the spring floods. Although it is slightly more than 1,300 mi. long, and drains an area of over 165,000 sq. mi., shoals, spring floods and summer droughts make navigation difficult, and the Don is commercially important in its southern portion only. Fishing and grape growing along the river's edge are the chief economic resources of a considerable population. The river is picturesque, the steepness of the right bank contrasting sharply with the flatness of the left. ROSTOV-ON-DON and VORONEZH, the farthest point navigable for large vessels, are the chief towns along its banks.

DONATELLO or **DONATO** (c. 1386-1466), Italian sculptor, was born in Florence about 1386. He studied with LORENZO GHIRBERTI and, with Brunelleschi, visited Rome, where he acquired a knowledge of classic form and ornament. With Donatello the true Florentine Renaissance begins, and his precept, "One should labor always with the Antique in mind and the living model before the eye," is a key to his realistic art. Donatello's most important works are: in the first, or Florentine period, 1405-33, the *St. Mark*, of Or San Michele, of which Michelangelo remarked that "it would be impossible to reject the Gospel from so straightforward a witness;" in the second, or Classic period, 1433-44, the relief of the *Annunciation* in the Church of Santa Croce, the singing choirs, at Prato and in the Cathedral Museum, and the bronze *David*, in the Bargello; in the Paduan period, 1445-53, the great equestrian statue of Gattamelata; in the fourth period, 1453-66, the two pulpits in the Church of San Lorenzo and the *Judith* in the Loggia de Lanzi, Florence. Donatello died at Florence, Dec. 13, 1466.

DONATI, GIOVANNI BATTISTA (GIAMBATTISTA) (1826-73), Italian astronomer, was born at Pisa, Dec. 16, 1826. In 1852 he became assistant at the astronomical observatory of Florence, and director in 1864. Of the four comets which he discovered the brilliant one of 1858 bears his name. He died at Florence, Sept. 20, 1873.

DONATISTS, a schismatic sect that arose in North Africa early in the 4th century, as an outcome of the persecutions of Diocletian. In opposition to the moderate policy of the Catholic Church in dealing with the traitors, who had surrendered the Christian sacred books to the pagans, they held that these traitors were not fit for fellowship in the Church. According to the Donatists, the holy sacraments were invalid unless administered by a priest who was himself blameless, whereas the Church maintained that the sacraments were valid regardless of the minis-

trant's character. The sect took its name from Donatus the Great, bishop of Carthage, who was its foremost champion.

Following a Church synod held in 411, harsh measures were taken to suppress the Donatists; but the sect did not disappear entirely until the Mohammedan invasions in the 7th century.

DONCASTER, a county borough of south Yorkshire, England, situated on a ridge dividing the watershed of the Don and Trent rivers, 156 mi. north of London. The name is of Roman derivation, but modern Doncaster, smoky and manufacturing, has little to remind of its antiquity. A famous old parish church, burned in the middle of the 19th century, was replaced by a fine, cruciform, Decorated structure. The course outside the town where the St. Leger race is run every September, was inaugurated in 1776, but as early as 1600 the town-fathers provided for the maintenance of a racetrack. There are numerous coal mines in the neighborhood, and a thriving agricultural trade exists together with brass, wagon, iron and machinery works; woolen and wall-paper mills. Doncaster has long been famous for toffee and chocolate. Pop. 1921, 54,064; 1931, 63,308.

DONEGAL BAY, an inlet of the Atlantic Ocean, indenting the northwestern coast of the Irish Free State. It extends about 25 mi. into the county of Donegal, and the city of Donegal is located at its head. The bay is 30 mi. wide at its entrance. On its southern shore it receives the River Erne which enters it over falls at Ballyshannon.

DON GIOVANNI, an opera in two acts by WOLFGANG MOZART, libretto (based on an old tale) by Lorenzo da Ponte; première, Prague, 1787, Vienna, 1788, London, 1817, New York, 1826. Produced a year after *Le Nozze di Figaro* and three years prior to *Die Zauberflöte*, it shares with both the distinction of belonging to the three most universally popular of the composer's operas. The composer was only 31 when he wrote the score, for which he was paid 100 ducats, or about \$240.00. It is a miracle of mingled freshness and maturity. Incredibly fertile throughout his short life, Mozart exceeded even his own standards by composing the overture in a single evening on the day before the première.

Beguiled by the charms of Donna Anna, the gay libertine and Spanish nobleman, Don Giovanni, plans to seduce her. He hence goes at midnight to the lady's palace. She resists him, and her father, Don Pedro, commandant of Seville, dashes to her aid. In the fight that follows, Don Giovanni kills him, escaping for the moment unrecognized. In the meantime, however, Giovanni's wife, Donna Elvira, has pursued her debonair husband to the city. In order to keep her at bay he instructs his servant, Leporello, to beguile the woman so that he will have time to seduce a pretty peasant girl, Zerlina, who has caught his fancy. She is to marry a peasant named Masseto, and Don Giovanni gives a ball in honor of the event which he decided to turn into a scene for his own amours. In this new passage at love he is interrupted

by the arrival of three persons who have vowed vengeance against him—Donna Anna, her lover, Don Ottavio, and Donna Elvira. The outraged trio catch the Lothario, but to keep him prisoner is another problem. Don Giovanni pursues his amorous way indefatigably, being brought to a halt only when confronted with a statue of Donna Anna's father, the dead Don Pedro. In a moment of jest Don Giovanni invites the statue to sup with him; whereupon the statue, to the host's amazement, promptly accepts the invitation. More amazingly, when the feast is prepared the statue appears on schedule. He offers Don Giovanni the choice between damnation and repentance. The murderer and tireless lover refuses to consider repentance and, so, seized by the marble hand, he is dragged down to the infernal regions.

DONGOLA, the capital of the province of Dongola, in the Anglo-Egyptian Sudan, Africa. It is important as a military depot and as a nucleus for trade and agriculture. Increasing quantities of American cotton are being produced. Pop. 10,000.

DONIZETTI, GAETANO (1797-1848), Italian music composer, was born at Bergamo, Nov. 29, 1797. He studied at the Naples and Bologna conservatories. Taking *ROSSINI* as his model, he rapidly achieved popularity as a melodist. His output, however, was so great (from 1822 to 1836 he averaged three or four operas annually) that the quality of his work inevitably suffered, and only a few of his 67 operas have escaped oblivion. Time has also dealt indifferently with his twelve string quartets and his six masses. He is now chiefly remembered for the operas *Don Pasquale*, *Fille du Regiment*, *Lucrezia Borgia*, *Lucia di Lammermoor*, *Favorita* and *Elisir d'Amore*. He died at Bergamo, April 8, 1848.



DONJON OF THE CHATEAU AT NIORT,
FRANCE

DONJON, the main defensive body of a feudal castle, sometimes called in English the keep, a massive tower which commanded all the defenses of the stronghold and at the same time was independent of them, since it often had a private concealed entrance

and exit without the walls. A typical and historically interesting donjon still to be studied is that of Loches, in France. The largest and most famous was the great circular tower of the 13th century chateau of Coucy. Good English examples exist in the Tower of London, late 11th century; Heddingham Castle, Essex, 1130, and Dover Castle, 1154. See **CASTLE AND CHATEAU**.

DON JUAN, a legendary adventurer whose completely sensual life, ending in his being carried off to Hell, has suggested dramas by "Tirso de Molina," Goldoni, Molière and others; operas by Mozart, Glück and others; and numerous poems, notably Lord Byron's *Don Juan*.

DONKEY ENGINE, a vertical fire-tube boiler with a small steam engine bolted to the boiler shell, often employed before the advent of electrical current where a small amount of power was needed. Many are still in use. The engine is usually placed with the cylinder above the crankshaft, the latter being in a horizontal position. However, these relative positions were reversed on some types. In a few designs the cylinder was within the steam space of the boiler, with the crankshaft at the boiler top. This arrangement reduced the cylinder condensation and improved the engine efficiency.

The term donkey engine is frequently applied erroneously to hoisting and hauling engines.

DON MARTIN DAM is located on the Rio Salado in the State of Coahuila, Mexico. The spillway of this dam, the first hollow concrete dam structure of the round-head buttress type ever built, is 768 feet long and has a maximum height of 105 feet. The buttresses are spaced every 29.5 feet and have a thickness of 6.5 feet. This spillway adjoins an earth dam 3,230 feet long, having a maximum height of 114 feet. An irrigation storage reservoir of 49 billion cubic feet capacity is created by it.

DONNAY, MAURICE CHARLES (1859-), French dramatist, was born at Paris, Oct. 12, 1859. In 1891 a series of Greek plays entitled *Phryné*, revealed Donnay as a promising dramatist. In 1892 Mme. Réjane appeared in his first full-length play, *Lysistrata*. With the production of *Amants* in 1895, Donnay became known throughout Europe. He wrote a score of plays, which include *L'Affranchie*, 1898, *Éducation de prince*, 1901, and *Le Retour de Jérusalem*, 1903, witty, colloquial and reflective of contemporary life. In 1907 he was elected to the French Academy, later becoming a commander of the Legion of Honor.

DONNE, JOHN (1573-1631), English poet and divine, was born in London in 1573. He studied at Oxford for three years, and in 1592 was admitted to Lincoln's Inn as a student of law. Later, while serving as secretary to Sir Thomas Egerton, he secretly married the niece of his patron who then had him imprisoned. After his release he and his wife suffered greatly from poverty, but on the accession of James I Donne's fortune changed.

The king persuaded the poet to study theology

and after his ordination made him royal chaplain and preacher to Lincoln's Inn in 1616. Donne's remarkable eloquence as a pulpit orator quickly won him wide renown in England and on the Continent. His sermons enjoyed extraordinary popularity. During his last years he was dean of St. Paul's and vicar of St. Dunstan's. Nearly all of Donne's verse was written during the first half of his life. It includes satires, amatory verse, lyrics, funeral poems, a series of epistles, and religious poems, and is characterized by ingenious fancy which frequently becomes fantastic by harsh and unmelodious versification, interest in ideas and the alternation of passages of great beauty with others of extreme obscurity of meaning. Donne died in London Mar. 31, 1631. See also ENGLISH LITERATURE.

BIBLIOGRAPHY.—Edmund Gosse, *Life and Letters of John Donne*, 1899

DONORA, a borough in Washington Co., southwestern Pennsylvania, situated on the Monongahela River, 20 mi. southeast of Pittsburgh. It is served by the Pennsylvania Railroad. Coal and gas are found in the vicinity. The chief local manufactures include steel, iron, zinc products, nails, fencing and chemicals. The retail trade in 1929 amounted to \$4,682,496. Donora is in a farming region. In 1920, 30% of the inhabitants were foreign-born white. The vicinity was a center of activity during the WHISKEY INSURRECTION, 1794. Donora was incorporated in 1900. Pop. 1920, 14,131; 1930, 13,905.

DON QUIXOTE, a satirical novel by the Spanish author, CERVANTES, the first part of which was published in 1605, the second part in 1615. The gentle old knight, Don Quixote de la Mancha, has read so many romances of chivalry that his imagination becomes inflamed to a fantastic extent. Convinced that he is living in the days of chivalry, the knight sets out to succor the world, equipped with a suit of ancient armor, astride his gaunt nag, Rozinante, and accompanied by that personification of common sense, SANCHE PANZA. Don Quixote appoints a red-cheeked country girl, whom he calls Dulcinea del Toboso, to be his lady, the guiding star of his wanderings. The adventures of the mad idealist and his practical-minded squire are vastly varied and comic. Every occurrence of their journey through Spain is colored by the old knight's imagination until it becomes a signal for some deed of high chivalry. Most people conclude that he is mad. His greatest battles are waged against a windmill and a flock of sheep. Always he comes off badly in his attempts to deal with the real world in his fantastic conception of it. Because he does struggle so hard to make the real coincide with the ideal, his most ridiculous misadventures often take on qualities of profound ironic truth. *Don Quixote* put to death for ever the romance of chivalry. Ranked as perhaps the first genuinely modern novel, its wisdom and humor keep it perpetually alive.

BIBLIOGRAPHY.—In Spanish, critical edition by J. Fitzmaurice Kelly and J. Ormsby, 1898-99; standard English trans. by Thomas Shelton, 1st part pub. 1612, 2nd part 1620.

DOOMS, decisions or enactments of the wise men or elders of the English moots. They were the fore-runners of the later decisions by the king's circuit judges and took the place of statute-making by Parliament, which did not become a common practice until the 13th century. The term doom was applied particularly in criminal cases, when judgment was handed down against the offender.

DOOMSDAY BOOK. See DOMESDAY BOOK.

DOOR AND DOORWAY. A door is an arrangement of material more or less rigid, hung or hinged in an opening to an enclosed space so as to allow or to prevent entrance or exit. A doorway is strictly an opening in which a door may be hung or placed; but the term is frequently used for any opening used as a passageway. The earliest doors were undoubtedly skins hung in the openings of primitive huts, and the use of similar soft door materials persisted well into civilized times and is preserved to-day in the frequent use of curtains or portières. Egyptian tombs of the 5th dynasty often bear representations of textile doors arranged to roll up. Wooden frames and paneled doors are also represented in early Egyptian paintings and carvings, and stone doors are known to have been used. Frequently, in the ancient Near East, wooden doors were covered with metal sheets, richly decorated.

Doors. In the Mediterranean world, under the classic influence of Greece and Rome, the wood paneled door with one or more panels and heavier rails and stiles was almost universal; these doors were usually pivoted at the top and bottom and not hinged. Bronze doors, often of great size and richness, were also common; that of the Pantheon at Rome still remains in use. Meanwhile, another type of door was being developed by the Germanic tribes to the north, the solid planked door. During the Romanesque and Gothic periods, both forms were in use; but the planked door was more common until the late Gothic period. Many flamboyant Gothic doors are rich not only with tracery, but with figures as well. Medieval doors were usually hinged, and the hinges often continued onto the face of the door as lavishly decorated elements. In the Renaissance simpler paneled types were again preferred; but with the development of the Baroque, though the panel scheme was preserved, greater and greater richness and playfulness of outline are to be found.

Mohammedan doors are also paneled; but the delight of the Mohammedans in complicated star-shaped polygonal and interlacing forms has given them a richness of effect unusual in paneled work. Chinese and Japanese temple doors are usually paneled, the lower panels being solid and the upper panels filled with an elaborate wooden grill, with paper, or in some modern examples glass, filling the spaces. Japanese house doors are usually sliding doors, very light, with a delicate wooden framework completely covered with paper.

The paneled door is still common in modern work, although now frequently of wooden veneer built up

on a soft wood core. This type of construction has led also to the development of the flush veneered door commonly used in hospitals, etc., and more and more common in other work, due to the beauty of its unbroken grain and its simplicity. Metal doors are also increasingly common. One type, known as the *kalamein* door, is formed of metal sheets locked and soldered together over a wooden core; it is usually of the paneled type. Better class metal doors are made with heavier metal sheets riveted or welded to a structural metal frame; these may be almost equally well paneled in type or flush. Modern mechanical ingenuity has developed many hardware devices of value, such as door closers, door holders, spring hinges and the like. See **HARDWARE**; **MILLWORK**.

Doorways. The doorway has always been an important feature in developed styles of architecture. Thus the Egyptians usually crowned important doorways with a great cornice, which often carried the winged Sun Globe, and the Assyrians banded the doorways with tile or sheathed the bottom with great man-headed winged bulls carved in stone. In many early styles, it was the custom to set up separate jamb stones and a heavy stone lintel, or, where the wall was sun-dried brick, to protect the corners with a wooden frame. If this surrounding frame is molded, a natural enframing decorative effect is produced. This banding of the doorway with bands and moldings became an almost universal feature in the classic styles of architecture. Such a combination of moldings and breaks around an opening is called an **ARCHITRAVE**. In many cases, the lintel was longer than the width of the doorway and the jambs, so that the molding around the edge projected at the top on each side, creating those projecting elements called *croisettes*, or keys. In the later classical styles, especially in the Baroque and Rococo, such projections from the simple line of the architrave were endlessly developed and complicated, and the decorative lines of the architrave doubled or trebled.

Medieval doorways were usually based on an entirely different scheme, the rectangular opening being capped with a semicircular discharging arch; the space between the horizontal lintel and the underside of the arch was filled with a thin wall or screen of stone, called a tympanum or lunette. By stepping the wide reveal outwards, a comparatively narrow door was made into an important decorative element, and the steps of the reveal offered marvelous opportunity for rich ornamentation by means of moldings, colonnettes, or statues. Similarly, the corresponding steps in the arch above could be carved and molded. In the Gothic period, curved tiers of little figures under canopies often occupied this space. The tympanum and the lintel were also sculptured. In important doorways, the doors were often in pairs, with a stone pier in the center; this pier usually carried an important statue. T. F. H.

DOPPLER, CHRISTIAN (1803-53), Austrian mathematician and physicist, was born at Salzburg, Nov. 30, 1803. In 1842 he discovered Doppler's prin-

ciple that the waves of vibration whose source approaches the observer are shortened, and those whose source is retreating are lengthened. Applying this principle to the stars by spectroscopy Doppler analyzed the separate motions of the two companions in binary stars. He died at Venice, Mar. 17, 1853.

DOPPLER EFFECT, the apparent change of FREQUENCY of a train of WAVES due to the relative motion of the source and the observer. If the sound of the whistle of a rapidly approaching locomotive be noted, it will be observed that, at the instant the locomotive passes, the PITCH of its whistle drops. If there is no relative motion between the source of waves and an observer, then the rate at which the waves reach the observer will be the same as the rate at which they are emitted by the source. If the source is approaching, the number of waves that reach the observer will exceed the number emitted by the number of WAVELENGTHS passed over by the source in one second. If the source is moving away from the observer, the rate at which the waves are received will be decreased by a like amount.

In the case of a LIGHT source moving away from an observer, the Doppler Effect causes a shift in frequency toward the red end of the SPECTRUM. The shifts of known spectral lines in the spectrum of the light from a star from the position occupied by the same lines emitted by terrestrial sources enable astronomers to determine the direction and magnitude of the star's motion relative to the earth. See also **SOUND**; **RADIAL VELOCITY**. P. E. S.

DORADO (gen. *Doradus*), the sword-fish, a constellation of stars of the third and fourth magnitude, to the west of Canopus. Part of the large MAGELLANIC CLOUD falls within the boundaries of Dorado.

DORCHESTER, a municipal borough and the county town of Dorset Co., England. It is situated on a prominence overlooking the Frome River, 6 mi. north of the English channel; served by the Great Western Railway. Brewing, malting and butter making are the important industries. Among the more distinguished structures are the guildhall, county building, the soldiers' quarters, St. Peter's Church and the County Museum. Thomas Hardy was born in the vicinity, and the town and the countryside are described in his novels. On or near this site was the Roman village of Durnovaria, and near by are the celebrated Maumbury Rings, the ruins of an amphitheater. Pop. 1931, 10,030.

DORCHESTER, now a district of Boston, Mass., but before 1870 a separate town of Norfolk Co., situated on Massachusetts Bay. To-day it is a manufacturing and residential section of the metropolis. Dorchester was founded in 1630 by English colonists and rapidly became one of the most important towns of New England. In its local government it formed a model for many other towns in the colonies. Dorchester is rich in historical associations, the Heights being particularly well-known as having been fortified by Washington so that the British were forced to leave Boston in 1776. See also **BOSTON**.

DORDRECHT or **DORDT**, a city in the Dutch province of South Holland, located on the Merwede. A medieval city in aspect it has a fine Gothic cathedral, 1363, a museum, a stock exchange and a city hall, 1850. The chief industries are shipbuilding and the manufacture of sugar, liqueurs, chocolate, cigars, metal ware, boilers and glass. There are also many saw and grist mills and breweries. In medieval times Dordrecht was the most important commercial city in Holland. Its trade is still important, particularly in lumber, Rhine and Moselle wines, coal, codfish and other staples. The harbor is so spacious that East Indian merchantmen dock at the city. Customs were collected there from 1018; in 1200 the city received municipal privileges and soon became the most important place in the county. It was the first city after Briel to drive out the Spaniards in 1572. That year the states of Holland held their first free assembly. In 1618-19 the Dordrecht Synod was held. That Great Synod of the Reformed Church maintained the strict Calvinistic dogmas, particularly predestination, and the liberals of the day were excluded from the church. The Netherlands, most of the Swiss cantons, the French Protestant churches, as well as the Puritans in England, accepted the Dordrecht articles. Pop. 1930, 56,180.

DORÉ, PAUL GUSTAVE (1833-83), French illustrator and painter, was born at Strasbourg, Jan. 6, 1833. His amazing facility as a draughtsman showed itself in early childhood and he may be said to have drawn his way through school. He went to Paris in 1848 and did his first illustrations for the *Journal Pour Rire* and *Journal Pour Tous*. His most important book illustrations were for Balzac's *Droll Stories*, 1855, Dante's *Inferno*, 1861, *Don Quixote*, 1863, *The Bible*, 1865, *Paradise Lost*, 1866, La Fontaine's *Fables*, 1867, and for Rabelais' works, 1873. Doré's genius for the fantastic and the grotesque gave him a great vogue, particularly in England and America, while in France he also achieved some reputation as a sculptor and painter of religious canvases. He died at Paris, Jan. 23, 1883.

DORIAN GRAY, THE PICTURE OF, a brilliant novel by OSCAR WILDE; published 1890. One day, while the artist Basil Hallward paints his portrait, Dorian Gray, in the prime of youth and beauty, expresses a wish that he may remain eternally young and that time and life may mark not his own face but that of his portrait. When this wish is miraculously brought to pass, it brings only tragedy in its wake. For, under the decadent influence of his friend Lord Henry Wotton, Dorian sinks deeper and deeper into degradation, until at last, with all the sins, including that of murder, upon his conscience, he meets an extraordinary death. The novel abounds in the epigrams for which Wilde was famous.

DORIC ORDER, the simplest and first of the Greek and the second of the Roman orders. See ORDER.

DORKING, a market town of Surrey, southeastern England. It is situated in a charming valley on the

Mole River; London lies 26 mi. to the northeast. A renowned breed of fowl, having five toes, is named after the town. Lime and chalk, procured from pits in the vicinity, and flour constitute the principal trade. Dorking was the home of George Meredith, who is buried here. Pop. 1921, 8,518; 1931, 10,109.

DORMONT, a residential borough in Allegheny Co., southwestern Pennsylvania, adjoining Pittsburgh on the south. The retail trade in 1929 amounted to \$5,512,346. Dormont was incorporated in 1909. Pop. 1920, 6,455; 1930, 13,190.

DORMOUSE (*Myoxidae*), a rodent exclusively of the Old World, squirrel-like in appearance but more nearly allied to the mouse. There are many kinds, one of which is found only in Africa. The common dormouse, a smaller creature than the others, the size of an ordinary mouse, with fine, soft fur, large eyes, full tail, rufous coat, and fore limbs short in proportion to the hinder ones, occurs throughout Europe to Russia and northern Turkey. Resembling the squirrel in its manner of sitting up and grasping its food, in the nature of its nutty fare, and in its arboreal life, it differs in being nocturnal and in hibernating. By October it takes on considerable fat, then retires to its nest. On a mild winter day it may awaken and eat from its store of nuts and grain. In March or April, when the fat is gone, it resumes activity. The winter nest is built in dense thickets of intertwined herbage spherically formed, with the opening at the top. The squirrel-tailed dormouse has been esteemed a delicacy since Roman times. The garden dormouse approaches closer to man's dwellings than do the others, which are wood-dwellers, and destroys fruit grown on walls and trellises. The common and the squirrel-tailed dormice make easily tamed, attractive pets.

DORNOCH, a royal burgh of Scotland, located about 143 mi. directly northwest of Edinburgh, on Dornoch Firth. There are remains of an ancient castle and bishop's palace. The 13th century cathedral is now the parish church. Because of its situation and golf courses, Dornoch is something of a holiday resort. Across the Firth stands Skibo Castle, which had been owned by Andrew Carnegie. Pop. 1921, 768; 1931, 725.

DORPAT. See TARTU.

DORR'S REBELLION, 1842, a contest of the unenfranchised classes in Rhode Island against the conservative, property holding, voting class. Thomas W. Dorr led the movement to abrogate the antiquated qualification for suffrage, which had survived since 1798. A democratic party organized in 1840 called a constitutional convention, which framed a constitution including the desired reforms. That constitution was accepted, in Dec., 1840, by a popular vote; the state legislature, controlled by conservatives, adopted a constitution which the people rejected. Both parties chose governors in 1842, Dorr being elected by the Suffragists and Samuel W. King by the Landholders. King, accepted by the legislature, proclaimed martial law; Dorr attempted to promote an uprising, but his

support collapsed. Extradited from Connecticut, where he had fled, Dorr was convicted of high treason, 1844, and sentenced to life imprisonment. A few years later he was released. The suffrage qualifications and the apportionment of representatives were, however, changed as he had advocated.

DORTMUND, the largest city of the Prussian province of Westphalia, located about 43 mi. east and north of Dusseldorf. It lies in the eastern division of the central zones of the great Rhenish-Westphalian coal and industrial region. The old nucleus of the city has many promenades, these having supplanted the fortifications. The most important buildings in the inner city are the Reinold's Church, 13th century, the rathaus, built in the 13th century, renovated in 1899, one of the oldest town halls in Germany, and the Guild House. The ancient city is the business center. The neighboring city of Horde was merged in 1928. The great steel and iron works are in the north and west, where the large harbors of the Dortmund-Ems Canal are located. Dortmund's importance is due to the coal along the banks of the Ruhr in Westphalia, which is responsible for the rapid growth of the city. Dortmund, mentioned in 899, was frequently visited by the German kings and emperors. Pop. 1925, 321,743.

DORY, or John Dory, (*Zeus faber*), a fish found in the Mediterranean and on the Atlantic coast of Europe, known for its excellent food value. Its yellowish-green, compressed body, less than 2 ft. long, is distinguished by the strong spiny portions of the dorsal, anal, and pectoral fins. The spines are separated by a soft-rayed tissue. Strong, wide jaws enable the dory to devour easily many smaller fish which it attacks voraciously. During the greater part of the day it is inactive, often hiding under rocks, from which it suddenly darts after its prey.

DOS PASSOS, JOHN RODERIGO (1896-), American novelist, was born in Chicago, Ill., Jan. 14, 1896. He was graduated from Harvard University in 1916 and served in France with the American Expeditionary Forces. His first notable book was *Three Soldiers*, 1921, a widely acclaimed war novel. Among Dos Passos' other works are *Manhattan Transfer*, 1925, *The 42nd Parallel*, 1930, and *1919*, published 1932.

DOSSAL, a curtain hung behind the altar and usually corresponding to the LITURGICAL COLORS.

DOSTOIEVSKI, FEODOR MIKHAYLOVICH (1821-81), Russian novelist, was born at Moscow, Oct. 30, 1821. He came of a humble family and struggled with poverty practically to the end of his life. He was educated at Moscow and at the School of Engineering, St. Petersburg. After the death of his father in 1844, Dostoevski gave up a commission in the army to devote himself to literature. His first novel *Poor Folk*, published in 1846, was fairly successful and was followed by *The Double*, a second novel, and by *The Landlady* and other stories. In 1849 the author was arrested for political activity and condemned to prison life in Siberia, where he spent 4 years. He describes his terrible experiences there in

The House of the Dead, published in 1861. Soon after his return to St. Petersburg a series of financial failures as journalist and editor forced Dostoevski to leave Russia. He lived abroad in wretched circumstances until 1871. Then he again returned to St. Petersburg, and remained there until his death, Jan. 28, 1881. Dostoevski's three most famous novels are *CRIME AND PUNISHMENT*, *The Idiot*, 1868, and *THE BROTHERS KARAMAZOV*. Among his other works are *The Possessed*, *The Gambler*, 1867, *A Raw Youth*, 1875, and *An Author's Diary*. Most of the novels are long, crowded with situations and scores of characters. All are charged with that intense, demoniac vision of life, the vision of an epileptic genius, which makes Dostoevski unique and one of Russia's greatest novelists.

BIBLIOGRAPHY—*Works*, trans. by Constance Garnett, 12 vols., 1912-20, L. F. Dostoyevski. *Fyodor Dostoyevsky*, 1922; J. M. Murry, *Fyodor Dostoyevsky*, new ed. 1924; André Gide, *Fyodor Dostoyevsky*, trans. 1926.

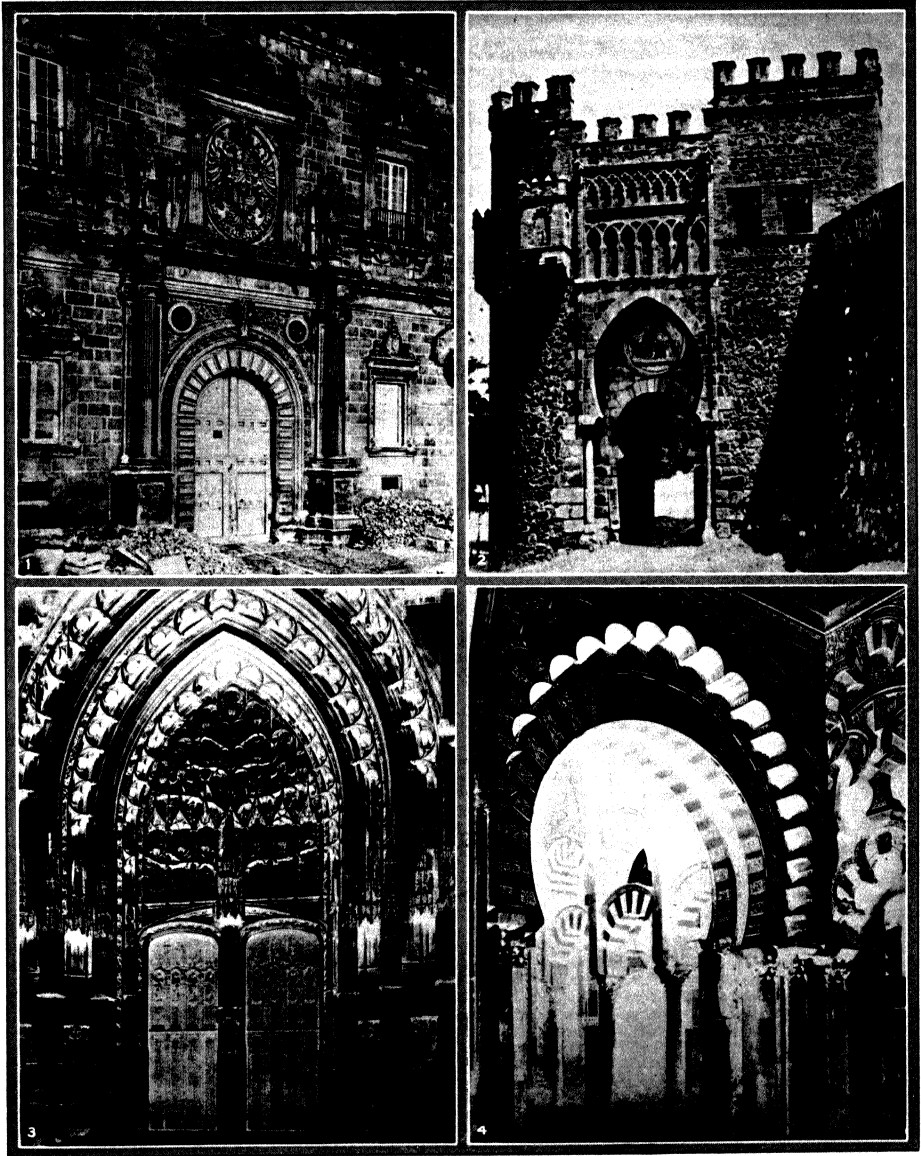
DOTHAN, a city of extreme southeastern Alabama and the county seat of Houston Co., about 15 mi. from the Alabama-Florida state line. The Atlanta and St. Andrews Bay, the Atlantic Coast Line, and the Central of Georgia railroads serve the city. The leading crops of southeastern Alabama are cotton, corn, peanuts and potatoes. Dothan's diversified manufactures include peanut-oil. It also has cotton-gins and compresses, and industries related to the raising of livestock in the vicinity. In 1929 the value of the manufactures was about \$2,000,000; the retail trade amounted to \$6,937,713. There are extensive forests of yellow pine south of Dothan. The city, founded in 1884, is governed under a revised charter of 1901. Pop. 1920, 10,034; 1930, 16,046.

DOU or DOW, GERARD (1613-75), Dutch genre painter, was born at Leyden, Apr. 7, 1613, one of the last of the Dutch Little Masters. The son of a glass merchant, he began as a glass painter. After studying with Rembrandt, he attempted portraiture but soon turned to genre work. Episodes of bourgeois or peasant life were his specialty: the celebrated *Woman Sick of the Dropsy* in the Louvre, Paris, and *The Poulterer's Shop* in the National Gallery, London, are typical. His powers of observation were great, his execution skilful and his colors usually soft and harmonious. Though his light and shade effects show the Rembrandt influence, his brushwork entirely lacks his master's breadth, his surfaces are unpleasantly glassy and in composition he has lost the simplicity of the earlier Little Masters. Dou died at Leyden in Feb. 1675.

DOUAI, a center of metallurgical industry located about 20 mi. by rail south of Lille in northern France. During the religious wars a strong Catholic city, it gave its name to the Douai Bible published here by English Roman Catholics in 1610. Douai has an arsenal and cannon foundries, schools of mines artillery construction and agricultural industries. Pop. 1931, 41,598.

DOUBLE ALLEGIANCE, a condition which exists when a person is a citizen of one state by right

DOOR AND DOORWAY



FAMOUS DOORS AND DOORWAYS OF SPAIN AND FRANCE

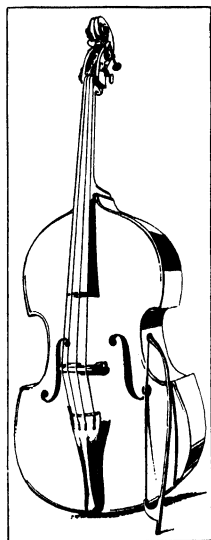
1. Round arched metal door of the principal entrance of the Alcazar, Toledo, Spain. 2. Horseshoe arch of the Puerta del Sol, Toledo, built about 1100. 3. Carved wooden doors and pointed arch of the north transept of the Ca-

thedral of Beauvais, France. 4. Arched doorway supported by columns in Cordova Cathedral, Spain, showing characteristic Moorish style in the combination cusped and plain horseshoe arch and heavy ornamentation.

of birth within its borders, and a citizen of another by reason of the nationality of his parents. In this case he is a citizen of the state of his birth by the *jus soli*, and of his parents' country, *jus sanguinis*. A conflict arises when the claims of both states are urged. If the father of a child moves to a new country and acquires the allegiance of the country of his new residence there is a definite conflict. The child has the allegiance of the father through his naturalization, and also the allegiance of his place of birth. The child upon reaching his majority may elect his nationality. A person also has a dual allegiance where he is a citizen of one country by birth, and of another by process of naturalization.

DOUBLE BASS, the largest and deepest of bowed string instruments used in the ORCHESTRA and generally similar to the violoncello except that it is larger. During the 17th and 18th centuries it commonly was

furnished with three strings only, but since then has been regularly furnished with four strings tuned in fourths, E being the lowest note written for it. Since it is a transposing instrument the lowest tone it actually sounds is an octave lower, namely E₂. Its upper compass extends audibly to d above middle C. Modern composers occasionally call for special tuning; for example, Richard Strauss's *Also sprach Zarathustra* requires double basses yielding C₂, a major third lower than the ordinary tuning of the lowest string, but such departures may be considered exceptional. Although an instrument that is somewhat unwieldy, the double bass lends itself, in the hands of skilled performers, to fairly rapid passage work such as the Trio in the *Scherzo* of Beethoven's *Fifth Symphony* in C minor, one of



COURTESY M. W. OF ART

DOUBLE BASS
Made in Europe in the 19th century

the earliest compositions in which this gigantic instrument was invited to imitate the flexibility of the violoncello.

DOUBLE DAMAGES, damages allowed by statute in excess of actual damages suffered. Double damages are creatures of statute and are generally authorized in actions involving various types of wrongdoing. In some states increased damages may be imposed even for acts committed without wrongful intent. The increased damages are frequently assessed by the court under the statute allowing them, i.e., to the actual damages found by the verdict of the

jury is added a sum equivalent thereto as additional compensation for the injury to the plaintiff. (*Allo way v. Hickok*, 215 (N.Y.) App. Div. 86, 243 N.Y. 615.) The object of double damages is to deter or prevent the commission of certain conduct, or to impose a more severe penalty upon the wrongdoer. This is shown by the statute enacted in New York which makes a person liable for treble damages where such person willfully destroys or injures any REAL or PERSONAL PROPERTY of another. (N.Y. Penal Law, § 1433.)

DOUBLE ENTRY. See ACCOUNTING.

DOUBLE MAJORITY, an accepted principle of Canadian politics during the period of Union, 1841-67. As a deterrent upon purely sectional legislation and to avoid friction between Upper and Lower Canada, ministries were headed by one leader from each section, and all important measures had to receive the support of a majority of the representatives of the dominant party in Parliament from both old provinces. The principle was discarded by the Cartier-Macdonald ministry in 1858 and reinstated by the John Sanfield Macdonald-Sicotte ministry in 1861.

DOUBLE REFRACTION. A crystal of CALCITE, or iceland spar, and many other crystals have the property of splitting up a ray of LIGHT into two plane-polarized rays, the directions of polarization being at right angles to each other (see POLARIZATION OF LIGHT). The index of REFRACTION of the two components is different, and the crystal is said to show double refraction. If a point, *P* (see Fig. 1), be viewed through such a crystal, two separated images will be seen. In the case of calcite, if the crystal is rotated about a vertical axis, one image remains stationary and the other rotates with the crystal. The ray for the stationary image is called the *ordinary ray* and the other the *extraordinary ray*. The two are plane polarized at right angles to each other. The extraordinary ray is deviated even at normal incidence.

The crystals which have been studied the most in this connection are calcite and QUARTZ. If one imagines light emanating in all directions from a point, *O*, within a calcite crystal, one of the components, the ordinary ray, behaves in the normal way in that the velocity is the same in all directions, i.e.,

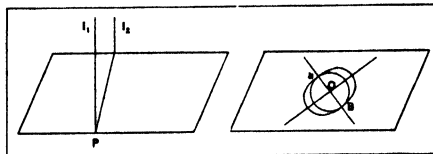


FIG. 1

FIG. 2

the index of refraction is constant and the wave front is a sphere. The other component will travel with different velocities in different directions and the wave front is an ELLIPSOID. A section of the wave front would be as shown in Fig. 2. In the direction, *AB*, the two components have the same velocity and this

direction is called the optic axis. A rotation about *AB* gives the spherical and the ellipsoidal wave fronts. As the two are in contact at only points *A* and *B*, such a crystal is said to be uniaxial. Any plane through *AB* is called a principal section. The velocity of the extraordinary ray in any direction is proportional to the radius vector of the ellipsoid and is a maximum with minimum index of refraction at right angles to the optic axis. The indices of refraction for calcite with Sodium light are 1.658 and 1.116.

In some crystals, such as quartz, the velocity at right angles to the optic axis is less, and the ellipsoid becomes a prolate spheroid, remaining uniaxial. In all optically uniaxial crystals, the ordinary ray is polarized in the principal section and the optic axis is independent of WAVE-LENGTH.

In some crystals, such as SELENITE, a more complex situation arises, in that neither of the waves has a constant velocity, so that both waves are extraordinary and there are three principal refractive indices. There are two directions for which both waves have the same velocity, and, therefore, there are two optic axes. Such crystals are said to be optically biaxial.

When plane-polarized light is passed through a section of doubly refracting crystal it will, in general, be resolved into two plane polarized components which travel through the crystal with different velocities. Upon recombination of the components in any one plane by an analyzer, phase differences will have appeared giving rise to INTERFERENCE OF LIGHT phenomena. The very striking color effects which are produced are a source of much information and a thing of great beauty. The science of petrography makes much use of these phenomena. They have also been used to study stresses in structural members.

P. I. W.

BIBLIOGRAPHY.—R. A. Houstoun, *Treatise on Light*, 1927.

DOUBLE SHUFFLE, in Canadian history, a notorious political maneuver, 1858, whereby the Macdonald government (see MACDONALD, JOHN A.), desirous of perpetuating its control but fearing an appeal to the electorate, took advantage of the law providing that a minister who resigned and within a month accepted another portfolio did not thereby vacate his seat in the assembly, by effecting a general redistribution of portfolios among the same group of ministers.

DOUBLE STARS, the name given to two stars appearing very close together in the sky. They are of two kinds: the optical doubles, where the two stars are really at very different distances from us, and only appear close together because they happen to be seen in nearly the same direction from the earth, and the physical doubles, where the two stars are really near each other. More than 20,000 double stars are known, the vast majority being physical pairs, or binaries.

A few physical pairs can be seen with the unaided eye, such as MIZAR and ALCOR. The majority, however, require a telescope to separate them distinctly into their components. When the two components of a double star are so close that they defy separation

with even the greatest telescope, their motion around each other is often so fast that this motion may be detected with the spectroscope; they are then called SPECTROSCOPIC BINARIES. When, in the latter case, the path of one star is such that it may at times pass between us and the other star, and thus eclipse some of the light of the other star, the pair is called an ECLIPSING BINARY. The number of double stars in the universe must be enormous, and it is estimated that at least one star out of five is double.

Wherever the relative motion of the stars has been sufficient to calculate the orbit of the one star around the other it has been found that this could always be represented by an ellipse with the other star in one of the foci, thus constituting an adequate proof that the law of gravitation is the same throughout space as it is in the solar system. When the orbit of a double star is known, as well as its distance from the earth, the mass of the system may be derived. It has been found that the vast majority of stars have masses between one-tenth and ten times that of the sun. The periods of revolution in the orbits of double stars range from a few hours for spectroscopic binaries, to a hundred thousand years or more for wide pairs.

W. J. L.

DOUGHERTY, DENIS J. (1865-), American cardinal, was born at Girardville, Pa., Aug. 16, 1865. After graduating from St. Charles Seminary at Overbrook, Pa., he was ordained, May 31, 1890. In 1903, he became the first American Bishop of Nueva Segovia in the Philippine Islands, being transferred five years later to the episcopal See of Jaro, also in the Philippines. In 1915, he returned to the United States and after three years as Bishop of Buffalo, N. Y., was enthroned as Archbishop of Philadelphia. Pope Benedict XV made him in 1921 cardinal priest with the title of SS. Nereus and Achilleus on the Appian Way.

DOUGHFACES, a name applied during the controversy over slavery in the United States to northern politicians who were unduly compliant to the desires of the South. The metaphor suggests the pliability of dough. The term was first used by John Randolph of Roanoke in characterizing the northern congressmen who voted for the MISSOURI COMPROMISE.

DOUGHTY, CHARLES MONTAGUE (1843-1926), English explorer and writer, was born at Theberton Hall, Suffolk, Aug. 19, 1843. He was educated at King's College, London, and at Cambridge, specializing in natural sciences. He traveled through many countries, studying geography, archaeology and ethnology before his two-year sojourn with the Bedouins of the Arabian desert. In 1888 he published the record of this exploration in *Travels in Arabia Deserta*, a work monumental for its pure prose as for its information. The remainder of Doughty's life was spent, for the most part, in England, where he wrote poetry. *The Dawn in Britain*, an epic, appeared in 1906. It was followed by *The Cliffs*, 1909, *The Clouds*, 1912, *The Titans*, 1916, and *Man-Soul*, 1920. Doughty died in Kent, Jan. 20, 1926.

DOUGHTY, THOMAS (1793-1856), American landscape painter, was born in Philadelphia, July 19, 1793. With very little instruction, he began painting and soon was rated as one of the foremost landscape painters of the HUDSON RIVER SCHOOL. He worked in Paris, London and Boston. The characteristic tone of his small landscapes is a silvery gray. Examples of his work hang in the Metropolitan Museum, New York, the Pennsylvania Academy of Fine Arts, Philadelphia, the Brooklyn Institute, and the Corcoran Gallery, Washington. Doughty died in New York City, July 22, 1856.

DOUGLAS, DAVISON McDOWELL (1869-1931), American educator, was born at Blackstock, S. C., June 20, 1869. He studied at Davidson College and Louisville Theological Seminary, and was ordained a Presbyterian minister in 1900. He occupied various pastorates and from 1911 to 1927 was president of the Presbyterian College of South Carolina. In 1927 he became president of the University of South Carolina. He died at Columbia, S. C., Aug. 1, 1931.

DOUGLAS, GAWIN or GAVIN (c. 1474-1522), Scottish poet, was born about 1474, third son of Archibald, 5th Earl of Angus. He was educated for the church at St. Andrews, and became Bishop of Dunkeld in 1515. He was banished from Scotland for political reasons in 1520, but was well received in London by Henry VIII. His principal work is a translation of *THE AENEID* into Scottish verse, published 1553. Douglas died of the plague in London, in Sept. 1522.

DOUGLAS, (GEORGE) NORMAN (1868-), English author, was born in 1868. His first sketches were published in *The Zoologist* in 1886. He has recorded his extensive travels in a number of books and has written many essays, books of description and fiction. His works include *Together*, *Siren Land*, *South Wind*, *They Went*, *Old Calabria*, *Alone*, *Birds and Beasts of the Greek Anthology*, *D. H. Lawrence and Maurice Magnus*, *Experiments*, *Fountains in the Sand*, *In the Beginning*, *Good-by to Western Culture*, 1930, and *How About Europe*, 1931.

DOUGLAS, STEPHEN ARNOLD (1813-61), American statesman, was born at Brandon, Vt., Apr. 23, 1813. When a boy he moved with his family to Ontario Co., N.Y., where he attended Canandaigua Academy and later studied law. In 1833, he wandered successively to Cleveland, O., St. Louis, Mo., and Winchester, Ill., where he taught school for a few months. He moved to Jacksonville, Ill., in 1834 where before the age of 21 he was admitted to the bar and began the practice of law. Douglas, upon attaining his majority, energetically entered politics as a Democrat and held a number of local and state offices. He was elected state's attorney for the first judicial district, 1835, was appointed register of the land office in the new state capital, Springfield, in 1837, was appointed secretary of state for Illinois in 1840 and the following year was appointed a judge of the Supreme Court of Illinois. Of small stature, but with a powerful voice and an alert, shrewd mind,

he was an excellent political campaigner of the type popular at the time in the West. He was an amazingly indefatigable worker both in his own campaigns and those of other Democratic candidates. His strenuous efforts in the Congressional contest of 1837 in which Douglas was defeated by his Whig opponent by 35 votes led to his selection as Democratic state chairman in the presidential election year of 1840, when the Democrats triumphed in Illinois. In 1843, he was elected to the national House of Representatives, was twice reelected, serving until 1847 when the Illinois legislature elected him to the United States Senate in which body he served from Dec. 1847 until his death. He immediately was appointed chairman of the Committee on Territories, and in that position he was necessarily a leader in settling one of the knottiest problems of the next decade, the disposition of the public lands which was entangled with the slavery controversy.

Douglas, taking the position that the slavery issue concerned the inhabitants of the states and not the national government, believed that the same right to decide for or against slavery should be extended to the territorial inhabitants. This doctrine was known as popular or "squatter" sovereignty. His compromising attitude met with the approval of many who desired the maintenance of the Union and was disapproved by the extremists of both pro- and anti-slavery factions. He supported the measures of the Compromise of 1850 and drafted the bills which established territorial governments for New Mexico and Utah and left the question of slavery to these two territories, with the promise that their constitutions should decide for or against slavery when they were later admitted as states. In 1852 Douglas was an unsuccessful candidate for the Democratic presidential nomination and in 1854 he was chiefly responsible for the final form and passage of the Kansas-Nebraska Act, which declared the Missouri Compromise "inoperative and void" and left the question of slavery to the inhabitants of the two newly created territories.

Douglas, who was primarily interested in settling the region and thereby facilitating railway construction to the Pacific coast, underestimated the importance to many of slavery as a moral issue. Far from being a successful bid for the presidency, as the Act was characterized by his opponents, the measure alienated from Douglas large numbers of Northern Democrats and eventually the extreme Southern Democrats regarded his doctrine of popular sovereignty as an unsatisfactory defense of their peculiar institution of slavery. The grievous struggle for "bleeding Kansas" was attributed to Douglas by anti-slavery Democrats and in 1857 he lost the support of pro-slavery Democrats by attacking and helping to defeat the proposed admission of Kansas as a state under the pro-slavery Lecompton constitution. Douglas defeated Lincoln for the United States senatorship from Illinois in 1858 in a contest which was featured by their memorable debates. Douglas, defeated for the Democratic nomination by Buchanan in 1856, was

again a candidate in 1860. The convention met in Charleston, S.C., and after the withdrawal of Southern members as a protest against a platform in conformity with Douglas's principles, he was unable to muster the necessary two-thirds vote from the remaining delegates. The convention adjourned to a later meeting at Baltimore where Douglas was nominated. The bolting Southerners nominated a pro-slavery ticket which split the Democratic vote. Douglas, nevertheless, polled many votes in the South and his total popular vote which was only 489,495 less than Lincoln's was a tribute to his personal popularity. Before and after Lincoln's inauguration Douglas generously manifested an open and hearty endorsement of the policies of his successful rival. While on a trip to the Northwest for the purpose of arousing popular support of the war for the Union, he died at Chicago, June 3, 1861.

DOUGLAS, the capital of the Isle of Man, and a municipal borough and resort 80 mi. northwest of Liverpool, England. It is well-situated at the common outlets of the rivers Dhoo and Glass, on the east coast of the island, the three forming a crescent shaped bay. Some older houses and irregular, narrow streets survive but in the main, terraced rows of modern buildings have replaced them. A splendid marine walk extending for more than 2 mi. outlines the bay from Derby Castle on the north to Douglas Head on the south. The Manx National Museum at Douglas houses a remarkable and complete set of casts of Manx crosses. Three piers protect the harbor, with the castellated Tower of Refuge, 1832, marking the threatening Conister rocks at its entrance. There is constant communication by steamer with Belfast, and other leading British seaports. Pop. 1931, 49,338.

DOUGLAS, an industrial city of Cochise Co., in southeastern Arizona, situated on the Mexican border in an extensive mining region. An airport and the Southern Pacific Railroad serve the city. Smelting is the chief industry, and lead and copper ores from Bisbee and other mining localities are received in large quantities. It is the seat of Camp Harry J. Jones, a military post. About 50 mi. north is Coronado National Park, containing CHIRICAHUA NATIONAL MONUMENT. Douglas was founded in 1900 and incorporated in 1905. Pop. 1920, 9,916; 1930, 9,828.

DOUGLAS FIR (*Pseudotsuga taxifolia*), a magnificent timber tree of the pine family called also Douglas spruce and red fir, standing botanically somewhat intermediate between the hemlocks, the firs and the spruces. It is found from the eastern base of the Rocky Mountains northward from Mexico and Texas to Alberta and westward, except in the more arid regions, to the Pacific, attaining its greatest size and abundance in the coast region of British Columbia, Washington and Oregon. The tree grows from 70 to 250 ft. high, producing in dense stands clear straight trunks, 100 to 150 ft. high and 4 to 8 ft. in diameter, surmounted by a pyramidal or sometimes flat-topped crown. The branchlets bear spreading linear leaves, $\frac{1}{2}$ to $1\frac{1}{2}$ in.

long, and oval cones 2 to 3½ in. long with conspicuous bractlets. This immense forest tree, surpassed in height and massiveness only by the California sequoias, furnishes the strong, flexible, durable timber known commercially as Oregon pine, Oregon fir or red fir, of which a larger footage is cut annually



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

DOUGLAS FIR
Cone-bearing branchlet

than from any other single species of American tree. The lumber cut of Douglas fir in the United States in 1930 amounted to 6,453,043,000 bd. ft. valued at the mill at \$109,141,957, or 21% of the total lumber footage produced during that year. Of this lumber cut of Douglas fir Washington produced 59% and Oregon 36.5%. See also LUMBERING. A. B. J.

DOUGLASS, FREDERICK (1817-95), American Negro orator, was born at Tuckahoe, Md., probably in Feb. 1817. He was a mulatto slave, but was well treated as a child and taught to read. In 1838 he escaped from Baltimore and soon went to Massachusetts; taking the name of Douglass, he began to work with the Massachusetts Anti-Slavery Society. From 1841 to 1845 he lectured in the United States against slavery and in the two years following in Great Britain, where abolitionists raised the money to buy his freedom before his return to America. From 1847 to 1860 he published an abolitionist weekly in Rochester, N.Y., but he united with the less radical groups, and bitterly censured JOHN BROWN's famous raid. He published his autobiography in 1845, and later in revised editions. During the Civil War Douglass proposed the Union's use of colored troops. After the conclusion of peace he held several public offices, becoming American minister-resident and consul-general to the Republic of Haiti in 1889. He died in Washington, Feb. 20, 1895.

DOUKHOBORS, a name signifying spirit wrestlers given members of a cult which settled in communities in Saskatchewan and British Columbia in the early years of the present century. The sect, Russian, rapidly increased after its founding in 1740. It believes in an "inner light," the pre-existence and future of the soul, and rejects the authority of a visible church. The sect being extremely hostile to census-takers and other statisticians, its doctrines have never been put into writing. The Doukhobors have

always had an acknowledged leader, who receives precepts in visions. Sporadically persecuted for proselyting or for attempted evasion of military duties, the sect was championed by Tolstoi. In 1898 the Russian Government agreed to their emigration. The Canadian Government agreed to allow the Doukhobors to settle in a compact body, to grant military exemption and other concessions. From Jan.-June, 1899, the main body, 7,363 persons, arrived in Canada, and were settled in the vicinity of Yorktown, Swan River and Prince Albert.

After three years of rapid progress, the colonies erupted in 1902 in a religious craze. Sheepskin coats and boots were discarded as sinful, because coming from animals; dairy products were excluded from a diet already without meat, and the domestic animals were freed. The colonists commenced a march eastward, despite inclement weather, apparently to meet Christ. They were forcibly returned, and their animals herded and sold by the Dominion, the proceeds deposited in trust to relieve future distress among the Doukhobors. Peter Veregin, who became leader of the cult in 1886, arrived in Canada in Dec. 1902. In May 1903, another pilgrimage commenced, in which the marchers were nude. The Dominion confined 24 of the adult males for three-months' sentences. Similar nudist pilgrimages occurred and were frustrated in July 1904, Aug. 1905, May 1906, and July 1907. Veregin bought fruit lands in British Columbia, and established a colony there. In that colony in 1925 the nudist craze reappeared. The march of that year, and sporadic recurrences, have been suppressed by the Mounted Police.

DOUMER, PAUL (1857-1932), French statesman and thirteenth President of the Third Republic of France, was born at Aurillac, Cantal, Mar. 22, 1857, the son of a provincial school-teacher. Largely by his own efforts he educated himself, and qualified as an instructor in mathematics. He moved to Paris to seek wider opportunities, and abandoned mathematics for journalism, in which he quickly made his mark. In 1886 Doumer was appointed secretary to the president of the Chamber of Deputies, to which he was elected the following year. Thenceforth his political advancement was uninterrupted. He was finance minister in 1895-96, governor-general of Indo-China in 1896-1902, president of the Chamber of Deputies in 1905-06, senator in 1912-13, minister of state in 1917, finance minister a second time in 1921-22, and president of the Senate in 1927-31. A Moderate-Conservative, he was elected President for the seven-year term in May 1931, defeating Aristide Briand; but he died May 7, 1932, from bullet wounds received the day before at the hands of a Russian assassin.

DOUMERGUE, GASTON (1863-), French statesman, 12th president of the Republic, was born at Aignes-Vives, Herault, Aug. 1, 1863. Educated for the law, he held public appointments in Cochinchina and Algiers, and in 1893 was elected to the Chamber of Deputies. He was minister for the

colonies 1902-05 and in 1906 became minister of commerce, an office which he held in several cabinets, later becoming minister of education. In 1910 he entered the Senate, and during 1913-14 was minister of foreign affairs, resigning when defeated in his support of the Three Years' Military Service Law. He was minister for the colonies again in the early part of the World War, again became senator, and in 1923 was chosen president of that body. He was president of the Republic from 1924 to 1931.

DOURINE, a disease of horses which much resembles human syphilis. It is caused by a blood parasite (*Trypanosoma equiperdum*) and first appears as painful lesions on the sexual organs of both male and female, usually within from ten days to two weeks of coitus. In mild cases there may be little constitutional disturbance but more frequently the lymphatic vessels and nervous system become affected, great debility and emaciation are manifested, the females abort and at last there is general paralysis causing death.

Dourine appears to be spread only through coitus and every attempt should be made to segregate healthy animals.

DOVE, HEINRICH WILHELM (1803-79), German physicist and meteorologist, was born at Liegnitz, Prussia, Oct. 6, 1803. After holding the chair of physics successively at Leipzig and Berlin universities, in 1848 he was appointed director of the meteorological department of the Statistical Bureau in Berlin. Dove advanced meteorological science by means of his researches on the varying temperatures on the earth's surface and allied climatological phenomena. He was the author of *Klimatologische Beiträge*, published during 1857-69. He died at Berlin, Apr. 4, 1879.

DOVE, in a broad sense a name for any pigeon but more commonly applied to various smaller members of the pigeon family, as the turtle, ring, stock and mourning doves. The domestic dove, the dove of folklore, literature, art and religious symbolism, is believed to be descended from the wild blue or rock pigeon (*Columba livia*) of Europe and Asia. Since remote antiquity the dove has been regarded as an emblem of gentleness, innocence and peace. According to Lepsius the dove is mentioned in Egyptian records as early as 3000 B.C. Through centuries of breeding an immense number of varieties have been developed, many of which, as the pouters, tumblers and fantails, are widely reared as ornamental birds. Though their flesh is excellent doves are of comparatively slight importance as a source of food. *See also* MOURNING DOVE; PIGEON.

DOVE COTTAGE, the home of the poet WILLIAM WORDSWORTH from 1799 to 1808, and the home from 1808 to 1830 of THOMAS DE QUINCEY, situated in the beautiful Lake Region near GRASMERE, Westmorland, England.

DOVEKIE (*Alle alle*), a very small species of auk breeding on the coasts and islands of the north Atlantic and wintering from Greenland to Long Island.

It is about 8 in. long with a very short broad bill. Its plumage is mostly sooty black above, grayish on the breast and white below. Maritime in habit, it lives chiefly in the open sea, feeding largely upon small fish and crustaceans. The dovekie is an expert swimmer and diver, and, although its wings are small, flies with great rapidity. On land it is awkward and comes ashore only to nest, laying a single bluish-white egg on a rocky cliff.

DOVER, a seaport and municipal borough of Kent, England, lying 76 mi. southeast of London at the mouth of the small Dour, the valley of which reaches the chalk cliffs of the coast. Dover is the only one of the Cinque Ports retaining prestige. A focal point of foreign attack for centuries, it has long been considered the key of England, though, paradoxically, Romans, Saxons and Normans did not enter there. The castle, probably one of the finest examples of medieval fortifications extant, bulks large on the cliffs 375 ft. above the sea. Although largely remodelled to the usages of modern warfare, still within its walls are a *pharos* (lighthouse), the one complete Roman structure in modern Britain; earthworks of British or earlier origin; eight Norman towers; a massive keep near which is Elizabeth's pistol, a huge cannon cast at Utrecht in 1544; a Norman moat; the round church of the Templars where John submitted to the papal nuncio, 1213; and the ancient chapel of St. Mary in Castro, remodelled in the 12th century and again in the last, and now the chapel of the garrison. Dover itself retains a certain picturesque character. The remains of fine old St. Martin's priory are traceable in Dover college, and the 13th century Maison Dieu, erected for pilgrims, was long used as the town hall. Outside the modern town hall hangs a German bell that sounded the alarm when the British squadron hove into sight at Zeebrugge. On the Marine Parade is a memorial to Captain Webb who first swam the English Channel, 1875, and there are monuments to Blériot and Rolls who first flew the Channel, 1909-1910. The port boasts the finest harbors on the east coast of England, the outer of which, once known as the Admiralty Channel, was ceded to commerce in 1923. Aside from heavy continental passenger traffic and mails, Dover has ship-building yards, victuals ships and trades in timber and rope. Pop. 1921, 39,999; 1931, 41,095.

DOVER, the capital city of Delaware, the county seat of Kent Co. It is situated in the central part of the state on St. Jones River, 44 mi. south of Wilmington and is served by bus lines and the Pennsylvania Railroad. The state house, a fine colonial edifice, was built as a court house in 1722 and later remodelled. The city is an important shipping point for fruit, vegetables, grain and poultry and has large packing houses and canneries. Near by is the State College for Negroes. The home of Caesar Rodney, a signer of the Declaration of Independence, is 6 mi. distant. Dover was founded by William Penn in 1683 and incorporated as a city in 1925. Pop. 1920, 4,042; 1930, 4,800.

DOVER, a city in southeastern New Hampshire, the county seat of Strafford Co., situated on the Cochecho River, 11 mi. northwest of Portsmouth. It is served by the Boston and Maine Railroad. Dover is a manufacturing center, making textiles, shoes, leather belting and machinery. In 1929 the total manufactures were approximately \$14,000,000; the retail trade amounted to \$7,922,888. The chief crops of the region are fruit and hay, dairying and lumbering also being important interests. The seat of the University of New Hampshire, incorporated in 1923, is five mi. southwest, at Durham. Dover was settled about 1623; chartered as a city in 1855. Pop. 1920, 13,029; 1930, 13,573.

DOVER, a town of Morris Co., N.J., located on the Rockaway River and on the Lackawanna and the Central of New Jersey railroads, 40 mi. west of New York City. It is a railroad center and has a number of important industries including the manufacturing of iron and steel products, hosiery, ranges, pneumatic tools and railroad equipment. The retail business in 1929 amounted to \$9,751,515. Nearby are located two large government munition depots. Dover was originally settled in 1722 and incorporated as a village in 1826; it was reincorporated as a town in 1869. Pop. 1920, 9,803; 1930, 10,031.

DOVER, a city in eastern Ohio, in Tuscarawas Co., and situated on the Tuscarawas River and the Ohio Canal, 102 mi. east of Columbus. It is served by two railroads. Coal, iron, limestone and fire clay are found in the neighborhood. The principal industrial establishments are foundries, brick works, rolling and flour mills. Electric apparatus and wire and hard rubber products are also manufactured. Wheat, corn and oats comprise the chief crops. Pop. 1920, 8,101; 1930, 9,716.

DOVER, STRAIT OF, a sea channel separating England from France, and connecting the English Channel with the North Sea. It extends on the English side from Dungeness to South Foreland and in France from Cape Gris-Nez to Calais. The width varies from 20 to 27 mi. and the depth from 10 to 130 ft. Chalk cliffs line both shores and plainly indicate that formerly the two countries were connected. Plans for tunneling the channel have been proposed but not carried out for military reasons. There is much boat travel over this route now.

DOW, GERARD. See **DOU, GERARD**.

DOW, NEAL (1804-97), American temperance reformer, was born at Portland, Me., Mar. 20, 1804. Of Quaker parentage he was educated in the Portland schools and at the Friends' Academy in New Bedford, Mass. His parents disapproved of his desire to go to college and study law, so he entered his father's tanning business in which he eventually became a partner. One of Portland's leading business men, in the later years of his life he devoted most of his time to politics and temperance reform. After local prominence as an opponent of the consumption of alcoholic beverages, in 1834 he was a delegate of the Portland Young Men's Temperance

Society to the first state convention at Augusta of the Maine State Temperance Society. Four years later with others he organized the Maine Temperance Union which went beyond the advocacy of merely moderate drinking and urged total abstinence. In 1845 the Temperance Union decided to favor prohibition by law and Dow traveled throughout the state stimulating public sentiment in favor of legislative action. A prohibition law was passed in 1846 which failed to provide for effective enforcement. In 1851 Dow was elected mayor of Portland and he requested the legislature to pass a bill which would permit the ending of the liquor traffic in the city. Dow drafted a bill and so effectively explained its merits before the legislature at Augusta that it was enacted into law, 1851, and achieved world fame as the "Maine Liquor Law." He toured throughout the North, speaking in favor of temperance and in 1853 served as president of the World's Temperance Convention in New York City. Soon after his reelection as mayor of Portland in 1855, riots in the city led to the repeal of the state prohibition law but it was reenacted in 1858. In 1857 in response to an invitation he traveled in England and lectured on prohibition.

Commissioned a colonel of volunteers, 1861, in the Civil War, he was promoted to a brigadier generalship. He was twice wounded and for eight months he was a Confederate prisoner. After the war he traveled and spoke in favor of prohibition in the United States and Great Britain.

In 1880 Dow was the presidential candidate of the Prohibition Party, receiving 10,305 votes and in 1884 he actively campaigned for the prohibition amendment of the Maine constitution which was carried. He died in Portland, Oct. 2, 1897.

DOWAGIAC, a city in Cass Co. in southwestern Michigan, situated 40 mi. southwest of Kalamazoo. It is served by the Michigan Central Railroad. The city is a shipping center for grain, fruit, peppermint and vegetables; and manufactures flour, lumber, furnaces, artificial fish-bait and other products. Dowagiac is in a charming lake region which has attractive summer resorts. It was settled about 1838 and incorporated in 1852. Pop. 1920, 5,440; 1930, 5,550.

DOWDEN, EDWARD (1843-1913), British literary critic, was born in Cork, Ireland, May 3, 1843. After studying at Queen's College, Cork, and at Trinity College, Dublin, he was appointed professor of English literature at Trinity. The work of criticism by which he is perhaps best known is *Shakespeare, His Mind and Art*, published in 1875. Other works on the great dramatist include the popular *Shakespeare Primer*. A poet himself, he was well equipped to write the masterly *Life of Shelley* which appeared in 1886. In addition to a *History of French Literature*, Dowden published a monograph on *Michel de Montaigne* and one on *Robert Browning*, as well as two volumes of *Studies in Literature*, and many other critical works of great value. Dowden died Apr. 4, 1913.

DOWER, a provision made by law for a widow out of the lands of her husband. At common law it is an estate for the life of the widow to the extent of one third in all lands owned by the husband in fee during the marriage. The subject has been dealt with by statute everywhere, and local legislation must be consulted in each state.

DOWIE, JOHN ALEXANDER (1847-1907), Scottish faith healer, was born at Edinburgh in 1847. After studying there for the ministry, he went to Australia and believing in his power of healing by prayer, he formed in Melbourne the Divine Healing Association of Australia and New Zealand. He went to the United States in 1888 where he later founded Zion City, establishing the Christian Catholic Apostolic Church, himself the self-styled apostle, also "Elijah II." In 1906 Zion City turned against him and deposed him. He died in Zion City in 1907.

DOWITCHER, a genus (*Limnodromus*) of medium-sized, long-billed birds of the snipe family (*Scolopacidae*). The eastern dowitcher (*L. griseus griseus*) of eastern North America, which was formerly shot in large numbers for the table, breeds in the far North and winters from Florida to Brazil. It is about the size of a Wilson's snipe but has its plumage spotted and barred with black, buff and white in summer and ashy gray and white in winter. Associating in large, compact flocks, it frequents bars and mud flats, feeding mostly on insects, mollusks and small shellfish. Its note is a shrill whistle. A slightly larger variety, the long-billed dowitcher (*M. griseus scolopaceus*), was formerly abundant in the interior and in the west, but both varieties have been so reduced in numbers by over-shooting that they have been removed from the game list.

DOWNERS GROVE, a village in Du Page Co., northeastern Illinois, 21 mi. southwest of Chicago. It is served by the Chicago, Burlington and Quincy Railroad. Downers Grove has green houses, dairy and poultry plants, and manufactures electrical supplies and appliances. The village was founded in 1833. Pop. 1920, 3,543; 1930, 8,977.

DOWNEY, a city in Los Angeles Co., southern California, 12 mi. southeast of Los Angeles, served by the Southern Pacific Railroad. Oranges, walnuts and deciduous fruits, truck farming and dairying are the chief interests of the countryside. The city has large fruit preserving factories and packinghouses, and manufactures airplanes and chemicals. Downey was founded in 1860. Pop. 1920, 4,500; 1930, 5,476.

DOWNING STREET, in London. A short street off Whitehall, containing various official residences which has led to its designation as the seat of government. No. 10 is the Prime Minister's official residence, where Cabinet meetings are generally held; the Chancellor of the Exchequer officially resides at No. 11; and opposite are the Foreign, Colonial and Home offices. The street was named after Sir George Downing (1624-84).

DOWNS, a name generally applied to the North and South Downs, two series of broad chalk ridges

in southeastern England. These ranges lie mainly in Surrey, Kent and Sussex, and are an extension of the chalk areas of Dorsetshire and Hampshire. The North Downs stretch from Farnham to the English Channel, with Dover on the east and Folkestone on the west; the South Downs start near Petersfield and reach the Channel at Beachy Head, 80 mi. away. Both ranges have gaps in which are fertile valleys, traversed by numerous rivers, roads and railways; the uplands themselves, with soil too light for farming, afford splendid pasturage. The landscape of the region is attractive, with the whiteness of the rounded hills concealed by woods and turf.

DOWSING, the English name for using the DIVINING ROD, usually a forked hazel stick, to find water or metal underground.

DOXOLOGY, a hymn or song expressing praise or glory to God, which the early Christian Church, following an ancient custom of the Jewish synagogues, used at the close of important liturgical prayers and sermons. Its simplest form was "to thee be glory throughout the ages!" The name was given to the last sentence of the Lord's Prayer. "The Angel's hymn," *Gloria in Excelsis*, is commonly known as the greater doxology, while the *Gloria Patria* is called the lesser. Other formulas, both Biblical and non-Biblical, have come into common use in the churches.

DOYLE, SIR ARTHUR CONAN (1859-1930), English writer, was born at Edinburgh, Scotland, May 22, 1859. While practicing medicine he published *A Study in Scarlet*, 1887, in which his famous SHERLOCK HOLMES first appeared, and of whom the original was Dr. Joseph Bell, Doyle's professor at Edinburgh University. Other novels followed, including *Micah Clarke*, 1888, *The Sign of the Four*, 1889, *The White Company*, 1891, *Adventures of Sherlock Holmes*, 1891, *The Memoirs*, 1893, *The Return of Sherlock Holmes*, 1904, and *The Case-Book of Sherlock Holmes*, 1927. Doyle was knighted in 1902. Other works include the play *The Story of Waterloo*, in which Sir Henry Irving acted, and histories of the Boer and World wars. After Doyle had lost a son, he made Spiritualism his religion. Among his Spiritualistic writings are *The New Revelation*, 1918, *History of Spiritualism*, 1926, and, unfinished, *The Edge of the Unknown*. Doyle died at Crowborough, Sussex, July 7, 1930.

DRACHMA, a monetary unit of Greece, equivalent, at par, to 19.295 cents in United States money, but which since the World War has fallen in value, until now it is about 1.30 cents. Also the name given for a weight now used in Greece for weighing gold, one drachma being equal to 15.433 grams.

DRACHMANN, HOLGER HENRIK HERBOLDT (1846-1908), Danish poet and novelist, was born at Copenhagen, Oct. 9, 1846. He is famous chiefly for his lyric poetry *Poems*, *Muted Melodies*, *Songs by the Sea*, *Vines and Roses*, *Youth in Poetry and Song*, *The Book of Songs*, etc. Many of his poems have been set to music. His prose fiction includes the novels. *A supernumerary*, *Tannhauser*,

Signed Away, *On a Sailor's Word and Promise* and others. He wrote also a number of plays, including *Once Upon a Time*, *A Thousand and One Nights*, *Volund the Smith* and *Honest Fellow*. Drachmann died at Copenhagen, Jan. 14, 1908.

DRACO (7th century B.C.), a Greek legislator, whose name is popularly synonymous with judicial severity. A small offense, according to his code, was punished as severely as murder. Although the Athenians would not tolerate his decrees, he nevertheless did much to improve the courts. He has been credited with introducing written laws but not a word remains of his harsh code, although he is mentioned by later Greek writers. His unpopularity forced him to leave Athens and he went to Aegina. There he died by suffocation in the theater, the enthusiastic people throwing their garments and caps on him, in the traditional mode of expressing popular esteem, for his achievement in reducing the laws to writing.

DRACO (gen. *Draconis*), the dragon, a constellation whose alignment of stars is so sinuous as to suggest a dragon, winds around between the Big Dipper and the Little Dipper. The head, very near the pole of the ECLIPTIC, contains the brightest stars, one of the second and two of the third magnitude. It was from observation of the brightest of these, Gamma, that the aberration of light was discovered. Alpha Draconis, a star of the third magnitude, was Pole Star about 4,600 years ago. See STAR: map.

DRACO, LAWS OF, a codification of unwritten laws of Athens made by the Archon Draco in 621 B.C. The exact nature of the laws, except that they were harsh and aristocratic in tendency, is unknown. From the evidence of ancient writers it appears that Draco's laws provided the death penalty for nearly all crimes. Solon, 594 B.C., repealed all but those dealing with murder. See ROMAN LAW: Twelve Tables.

DRACUT, a town of northeastern Massachusetts, in Middlesex Co., situated about 2 mi. from Lowell and 27 mi. northwest of Boston. It is in an agricultural region and trades in farm produce. The leading industry is the manufacture of woolen goods. Pop. 1920, 5,280; 1930, 6,912.

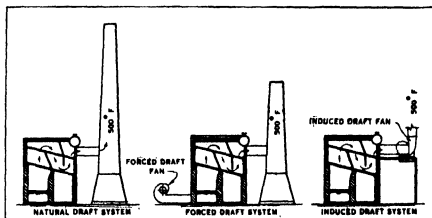
DRAFT, as a nautical term, is the distance from the water line a vessel is floating at to the lowest point of her hull. Draft figures six inches high spaced six inches apart are painted on the stem and also on the stern of a vessel.

DRAFT, as a military term. See CONSCRIPTION.

DRAFT, a flow of air or gases produced by differences in pressure at two or more points. A popular misconception is that draft is a pull or suction, but there is no such thing as suction in the usual sense. For example, what actually happens when liquid in, say, a glass is "sucked" up is that the air pressure in the straw above the liquid is reduced and the pressure of the atmosphere on the surface of the liquid, in the glass, pushes it up the straw.

Natural Draft may be defined as that obtained without fans or blowers. It is effected by allowing heated air or gases to enter a chimney. The heated

column of air in the chimney weighs less than a column of cool air correspondingly high, so there is a difference in pressure between the base and top of the chimney. Consequently, the cold air pushes the warm air up the chimney and produces a draft. The



COURTESY COMBUSTION ENGINEERING CORP.

SYSTEMS OF NATURAL, FORCED AND INDUCED DRAFT

intensity of the draft will depend on the height of the chimney and the temperature difference between the escaping gases and outside air.

Forced Draft may be defined as that in which air is supplied under pressure by fans or blowers at the fueling side of a furnace. The pressure of the air supply is made great enough to overcome the resistance of the fuel bed or burner, and so *reduce* the intensity of *natural* draft required in the furnace. The height of a chimney for a given operating condition is therefore reduced. In marine boilers forced draft is produced by tightly closing the entire firing room and supplying air to it under pressure by fans.

Induced Draft may be defined as that produced by a fan or blower located at the chimney side of a furnace and serving to increase the pressure which causes the gases to flow up the chimney. In this case, power is used to artificially increase the height of the chimney.

The three conditions of natural, forced and induced draft are diagrammatically illustrated in the figure.

O. DE L.; K. T.

DRAFT, BANK. See BILL OF EXCHANGE.

DRAFT GEAR, that part of the arrangement (see COUPLER) for connecting railroad cars designed to absorb the shock produced when a train is stopped or started. Draw heads have long been fitted with heavy spiral springs for this purpose, and these still serve for all ordinary shocks. For severe shocks, however, the modern friction draft gear has an additional spring which, by means of wedge-shaped pieces and friction "strips," produces an enormous longitudinal force. About 90% of the energy of the shock is dissipated as heat.

DRAFT RIOTS, disturbances in several northern cities, 1863, in opposition to the enforcement of the Federal Enrollment Act of Mar. 3, 1863, declaring all males, except certain exempted persons, between the ages of 20 and 45 liable for military service, and authorizing the President to make a draft by lot. The volunteer system, effective at the beginning of the Civil War, was proven inadequate despite the lib-

eral inducements which were made to men to volunteer. The Confederacy adopted conscription in 1862, and several northern states in the summer of that year attempted conscription unsuccessfully. The Federal law excited resentment, due to its affronting popular democratic beliefs, and particularly because its machinery was cumbersome and unfair. Irish laborers were particularly incensed at the Negroes, whom they fancied were to blame for the war, and began rioting. In New York City the mob got out of hand, set the enrollment building afire, and for three days held possession of the east side, pillaging and killing. Federal troops restored order after \$2,000,000 worth of property was destroyed and 1,000 persons killed or wounded.

DRAFT TUBE, a water passage which carries into an open stream, called tail-water, the flow from a reaction water turbine (see TURBINES, WATER) which, in order to permit easy access, has been set above the surface of the tail-water. Its use renders effective the fall from turbine to tail-water which otherwise would be lost. An essential feature of the draft tube is the *DRAFT* or suction existing in part of the tube when it flows full of water. The tube gradually enlarges toward its outlet, thereby reducing, to a small amount, the velocity of the water at exit and minimizing the waste of energy.

DRAG. See ROAD MACHINERY.

DRAGLINE EXCAVATORS, machines used extensively on heavy earth excavation. The simpler type comprises a scoop suspended from a swinging boom and drawn toward the machine by a cable attached to its front, a second cable at the rear holding it at the proper angle. When filled, the scoop is lifted to the point of the boom, which is then swung around to the proper position for dumping. This machine combines digging, elevating and conveying of the material under a single control. Large machines called "tower excavators" are similar in operation, but comprise two movable towers connected by a cable which carries the bucket. W. J. D.

DRAGO, LUIS MARIA (1859-1921), Argentine writer, lawyer, jurist and diplomat. Drago was elected to parliament in 1902, and later made minister of foreign affairs by Pres. Roca. In Dec. 1902 England, Germany and Italy attacked Venezuela by sea in order to oblige her to pay debts owed to their subjects. Drago thereupon sent his famous note to Washington, setting forth his viewpoint, known as the **DRAGO DOCTRINE**, Dec. 29, 1902. Drago undertook several important diplomatic missions, was professor of law in the University of Buenos Aires, and in 1907 he represented Argentina at The Hague Conference. He was author of many works. In 1909, he was elected by the United States and Venezuela to arbitrate questions of United States reclamations in Venezuela, but declined as he had been chosen several days earlier by Great Britain and the United States to arbitrate the question of fisheries in the North Atlantic. In 1910, he was a member of The Hague Conference and in 1912 was elected national deputy.

The Carnegie Foundation invited him to initiate visits to the United States as the "highest exponent of South American intellectual culture." He received the degree of Doctor of Laws from Columbia University in 1912. Drago died in 1921.

DRAGO DOCTRINE, the doctrine formulated in 1902 by Señor Drago of Argentina on the occasion of the blockade of Venezuela by Great Britain, Germany and Italy to the effect that a state has no right to intervene forcibly for the purpose of collecting the private claims of its citizens against another state. The HAGUE CONFERENCE in 1907 qualified the doctrine by holding that it should not be applicable when the debtor state refuses arbitration or fails to submit to an arbitral award.

BIBLIOGRAPHY.—C. G. Fenwick, *International Law*, 1924; J. H. Latané, *A History of American Foreign Policy*, 1927.

DRAGON, a giant mythical reptile, which plays a conspicuous part in the world's legends and fairy tales. There were many different species of dragons. Some, as the Chinese dragon, were wingless, four-footed serpents; others were great lizard-snakes with huge wings, which swept down from the sky; still others had two heads. People may have believed in dragons before historical times. Among the ancients, in the Near East, the dragon was conceived as the embodiment of evil, but in Greece and Rome it was sometimes thought to be wise and good. In Europe of the Middle Ages it was believed to be an evil power, the enemy of man and the church. One of the most worthy deeds a hero or saint could do was to slay a dragon. Even as late as the 16th century dragons were believed by many educated people to have a real existence.

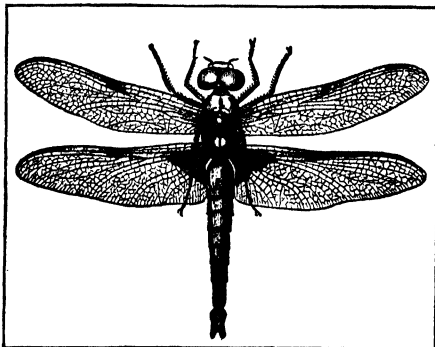
DRAGON, FLYING, agamid lizards (*Draco*) having the ability to glide from tree to tree by means of an extensible fold of loose skin along either side of the body. This skin is supported by false ribs. When



FLYING DRAGON

at rest on a twig the lizard applies itself so closely that it becomes almost invisible. At such times the lateral folds of skin are drawn in and pressed downward against the twig, materially assisting in breaking the visible contour of the body. The numerous species are inhabitants of southern Asia, the East Indies and Philippine Islands. The expanded "wings" of some forms are vividly colored and cause the gliding lizard to resemble a butterfly in flight. Flying dragons are oviparous, insectivorous and entirely harmless to man. The maximum length is about 10 in.

DRAGON-FLY, an insect of the order *Odonata*, sub-order *Anisoptera*. Two sub-orders are recognized in this group, the dragon-flies and the damselflies. In dragon-flies, the hind wings are larger than the fore wings. When at rest, both wings are extended horizontally. These beautiful insects are often seen dart-



DRAGON-FLY
Libellula quadrimaculata

ing up and down along a stream, or zigzagging above some larger body of water, in pursuit of their prey. They feed on smaller dragon-flies, as well as mosquitoes and other dipterous insects. Eggs are laid in or near the water. Immature forms are called nymphs. They are mainly aquatic and predacious. A greatly enlarged, hinged lower lip, fitted with sharp hooks, is folded beneath the head when not in use. It can be suddenly extended to grasp the prey. Some cling quietly to water plants, and stalk their prey when it approaches. Others bury themselves in mud or silt, only the bulging eyes and hinged lip exposed, ready to seize unwary insects. The caudal part of the alimentary canal is modified to form a respiratory chamber. They emerge from the water to transform. Newly emerged adults are soft and defenceless. When fully expanded, they fly away on powerful wings, to patrol the stream for food.

J. R. T.

DRAGONHEAD, a genus (*Dracocephalum*) of annual or biennial herbs of the mint family, several of which are grown in flower gardens. There are about 40 species, natives chiefly of Europe and Asia. They are mostly erect with entire toothed leaves and usually showy purple or blue flowers in axillary whorls or terminal clusters. The American dragonhead (*D. parviflorum*), which grows in gravelly soil from Quebec to Alaska and southward to Arizona, is a rather stout plant, usually 1 to 2 ft. high, with light blue flowers.

DRAGONNADES, a punishment inflicted upon the Huguenots at the time of the revocation of the Edict of Nantes. The quartering of soldiers in private houses was a common practice in France but was a hardship at best and caused terrible suffering when exercised upon the Huguenots in 1681 and succeed-

ing years. Brutal excesses were encouraged in order to break the courage of the unfortunate victims and more quickly lead them to renounce their faith. Ruthlessly carried on, the dragonnades became one of the most potent causes of the Protestant emigration that proved to be so serious in the economic and intellectual life of France after Louis XIV.

DRAGON-TREE (*Dracaena Draco*), a peculiar, long-lived tree of the lily family, native to the Canary Islands and sometimes cultivated in conservatories. It grows from 30 to 60 ft. high, developing remarkable girth and branching only when of great age. It bears large sword-shaped leaves in tufts at the ends of the branches, clusters of small greenish flowers and yellowish berries. From the bark is obtained a resin known as dragon's-blood, used in coloring varnishes.

DRAINAGE DISTRICTS. Early in the drainage development of the United States landowners found that their lands could be drained efficiently and economically only by systems serving several farms. This led to the legal provisions creating drainage districts and giving them all the powers necessary for the planning, financing, constructing and maintaining of outlet drainage systems (the individual farm lateral systems are not included in the district work). Such districts may issue bonds and other certificates of indebtedness, which are a lien on the lands benefited. They may sue and be sued. They have the power of eminent domain and may hold and transfer land. They distribute the costs of the improvements in proportion to the benefits conferred, levy taxes therefor and use the regular public machinery for collecting taxes. Their affairs are administered by officials elected by the interested landowners, or by designated public officials. W. J. S.

BIBLIOGRAPHY.—U. S. Department of Agriculture, *Bulletin* 1207; *Farmers' Bulletin* 815.

DRAINAGE OF IRRIGATED LANDS. See **IRRIGATION.**

DRAINAGE OF LAND, the drawing off of water from swamp and overflowed lands, accomplished by gravity flow or pumping, or by a combination of the two. Waste water is carried away by surface ditches or by buried conduits, pipes or tiles. In the case of overflowed lands, protecting levees and check gates or valves, in the outlets or sluices, may be required to prevent re-inundation during higher water stages. Pumping, at least periodically, may have to be resorted to in many drainage projects. It is used in connection with ditches and sumps, or with wells into which water is drained through the ground. F. R. H.

Agricultural lands are improved through the removal of surplus moisture on and in the soil by drains, and by preventing overflow from natural water courses by artificial channels or **LEVEES**. In addition to improving agricultural lands, the reclamation of wet areas benefits public health and aids highway and railway transportation.

Although the Romans used both open and covered drains, land drainage did not become important in

the agricultural development of the United States until the settlement of the Mississippi valley, where large areas of unproductive swamp have been converted into fine farm land. The major portion of the recent work has been in this section and in the Atlantic and Gulf coast states but present development lies in the improvement of lands nominally under cultivation, rather than the reclamation of new lands. See **LAND RECLAMATION.**

Consideration of certain relationships between soils, soil moisture and crop production gives the best understanding of the benefits of land drainage. Soil moisture may be divided into *capillary* moisture (see **CAPILLARY PHENOMENA**), which is held in thin films surrounding the soil grains, and *gravitational* moisture. As the **WATER TABLE** is approached the capillary films become thicker until they fill the soil pores. This moisture, in excess of that retained by capillarity, is the *gravitational*, or *surplus*, moisture which can be removed by drainage. Capillary moisture may be supplied by water percolating downward or it may be raised from the water table by capillarity.

The amount and rate of movements of these types of moisture depend upon the size and arrangement of the soil particles. In a coarse-grained soil the gravitational movement is rapid, while the capillary movement is slight. In a fine-grained soil the opposite is the case.

The removal of surface water is usually not sufficient for lands needing drainage. The surplus moisture in the soil also must be drawn off. Crop plants secure their moisture and food supplies from the capillary moisture only, and should, on the average, have a root zone about four feet deep. Drainage should control the water table so as to supply this zone, ordinarily free from surplus moisture, but to which capillarity can raise the necessary amount. The benefits from drainage result from physical, chemical and biologic actions made possible by the removal of the surplus moisture, which displaces all air. These actions increase the useful moisture and food supply, lengthen the growing and cultivation periods and decrease the costs of cultivation.

The more common types of drainage include: *Surface drainage* through open ditches or tile drains with surface inlets, which provides for the rapid removal of the surface water and furnishes outlets for underdrainage systems. *Underdrainage* through which the surplus soil moisture collects and flows to an outlet. Efficient underdrainage requires drains about four feet deep, and from 33 to 200 ft. apart, depending upon the soil and the crops. *Prevention of overflow* by artificial channels that carry the flood flows within their banks, or leveed natural or artificial channels. Where **LEVEES** are constructed provision must be made for draining the land back of them. *Pumping* in which the drainage channels lead to pumps which discharge into some outlet at a higher elevation. *Drainage of Irrigated Lands* made too wet by seepage from higher irrigated lands. Such

drainage presents special problems not encountered in the drainage of humid lands.

W. J. S.

BIBLIOGRAPHY.—C. G. Elliot, *Engineering for Land Drainage*, 1919; Iowa Engineering Experiment Station's *Bulletin* 50.

DRAKE, SIR FRANCIS (c. 1545-96), English admiral and navigator, was born near Tavistock, Devonshire, about the year 1545. At 22 he was in command of a vessel in Hawkins's fleet which fought the Spaniards in the Gulf of Mexico. In his ship the *Golden Hind* Drake sailed through the Strait of Magellan in 1577 and crossed the Pacific. He returned to England with a rich cargo of treasure and spices and was knighted by Queen Elizabeth as the first Englishman to round the globe. In 1585 he embarked on an expedition of conquest and plunder to the Spanish West Indies. He sailed as far north as Virginia, whence he may have brought back the potato and tobacco. In the spring of 1587 Drake commanded a fleet which raided the ARMADA then being brought together in the harbor of Cadiz, and the next year he captured one of the ships of the Armada as it neared the coast of England. Drake died in the Spanish West Indies, Jan. 28, 1596.

BIBLIOGRAPHY.—R. Hakluyt, *Voyages of Drake and Gilbert*, 1909.

DRAKE, JOSEPH RODMAN (1795-1820), American poet, was born at New York City, Aug. 7, 1795. He studied medicine, traveled abroad, and returned to America in 1819. The "Croaker" poems in the New York *Evening Post*, versified comments on public affairs from 1819-29, were written by Drake and Fitz-Greene Halleck. Drake's most famous poem, *The Culprit Fay*, resulted from a conversation with Cooper about the uses in poetry of the names of American rivers. "The American Flag," one of his most widely known poems, was written in his youth. Drake is the subject of Halleck's elegy beginning, "Green be the turf above thee." He died at New York City, Sept. 21, 1820.

DRAKENSBERG, a mountain range of South Africa, runs from the northwest corner of Natal, forms with its outposts the mountainous country of Basutoland, and continues through the Cape of Good Hope Province, first as the Stormberg and then as the Nieuweveld and Kamsberg mountains. The highest peaks are Champagne Castle (10,337 ft.), Mont aux Sources and Giant's Castle. This series of ranges, the most important system in South Africa, encloses on the north and east the great inland plains of South Africa which cover the northern portions of Cape of Good Hope, Bechuanaland and the whole of the Orange Free State, in relation to which the chains appear as a curved rampart. To the west this region is further circled by ranges which form a continuation of the system in the South West Africa Protectorate, from which they are divided by the Orange River, and culminate in the Roggeveld Mountains and the ranges behind Cape Town. The Lebombo range is the northern extension of the Drakensberg mountains.

DRAKE UNIVERSITY, at Des Moines, Iowa, a

coeducational institution founded in 1881, privately controlled and affiliated with the Church of Christ (Disciples), but without denominational restrictions. It has an endowment of \$1,731,879. The library contains 51,024 volumes. In 1930 there were 1,770 students, and a faculty of 101 headed by Pres. DANIEL W. MOREHOUSE.

DRAKE WELL MEMORIAL PARK, a tract of 22½ acres set aside in 1931 as a State park, situated in Venango Co., northwest Pennsylvania, near Titusville, surrounding the spot on Oil Creek where Col. Edwin L. Drake, in 1859, drilled the world's first successful oil well. The site of the projected park was offered as a gift to the State under the sponsorship of the American Petroleum Institute, and was accepted, Apr. 10, 1931, by Gov. Gifford Pinchot.

DRAMA, a Greek word signifying "action," used to express the portrayal on the stage of an acted imitation, more or less true, of scenes and incidents of real life. The GREEK DRAMA is the first of which there is any wide knowledge, the plays of AESCHYLUS, SOPHOCLES and EURIPIDES holding the boards even to the present day. In the Greek drama the three unities were generally observed; i.e., the unity of time demanded that the action take place within 24 hours, the unity of place demanded an unchanging scene, and the unity of action forbade the introduction of any independent sub-plot. The severity of these rules, which no other race has ever been able to observe with the same facility as the Greeks, naturally led to a corresponding severity of form in the Greek drama. It was relaxed somewhat by the comic dramatists of which ARISTOPHANES is the outstanding example; his plays, like those of the tragic dramatists, still find audiences in modern theaters. The Latin drama (see ROMAN DRAMA), if one may judge by the fragments that have come down, was very inferior to the Greek, and it is probable that the theater was not a popular amusement with the Romans.

During the Dark Ages, the drama went into almost complete eclipse, but it revived in France in the 11th century, when the MYSTERY PLAY became an overwhelmingly popular entertainment. Its subject was always religious and the modern Oberammergau play is an elaborate and more sophisticated version of the medieval miracle play. In the 15th century the French branched out to the dramatization of lay stories and to the allegorical play depicting the virtues and vices of the human kind. During the 17th century the Spanish drama exercised immense influence in France. It was both vigorous and original, and the old Greek rules had for the most part been discarded by the Spanish dramatists. LOPE DE VEGA and CALDERÓN are almost in the very front rank of world dramatists, and such was the vigor of their genius that it is not astonishing that Spanish dramatic influence spread, not only to France but to England also. Under this Spanish influence the French drama of the 17th century blossomed into its golden age, giving the world the tragedies of PIERRE CORNEILLE and RACINE and the immortal com-

edies of MOLIÈRE. Notwithstanding this influence, the French dramatists still adhered to the Greek unities, although a love affair now took the place held by fate and doom in the old Greek drama. Only in comedy was the severity of form relaxed. About 1830, with the rise of the Romantic School and the plays of Hugo, Dumas and de Musset, came the gradual eclipse of the old classical tradition, although it is probable that it still retains a tighter hold on the French drama than on that of any other country. See also FRENCH DRAMA, SPANISH DRAMA.

England's dramatic awakening came later than that of France. The mystery play was borrowed from France, but with the great Elizabethan dramatists appeared a school of drama entirely native and owing little to foreign influence. The defects of Shakespeare, Jonson, Beaumont and Fletcher, Massinger, Marlowe, Greene, Peele, Webster and Heywood (see separate articles on these authors) are a possible lack of finish and of the restraint and order so strongly a feature of the Greek drama; their merits are enormous vigor and power, great fertility, and a high poetical and romantic quality that has not been surpassed. The Elizabethans were succeeded by the comic dramatists of the Restoration, the plays of CONGREVE remaining popular to this day. With the 18th century came the comedies of OLIVER GOLD-SMITH and RICHARD SHERIDAN. The end of the 19th and the early part of the 20th centuries produced such dramatists as WILDE, PINERO, JONES, SHAW, BARRIE and GALSWORTHY. See also ENGLISH DRAMA.

Germany produced no international drama until the middle of the 18th century, when the plays of LESSING first appeared. SCHILLER and GOETHE represent the peaks of the German drama, the *Faust* of the last being a world masterpiece. It is possible that Germany's contribution to the drama has lain more in the direction of investigations of the theories of acting and of the possibilities of stage production than in the production of dramas themselves. See GERMAN DRAMA.

It is natural that in the United States the stage should at first have depended strongly on European, and especially English plays. Later there arose such popular playwrights as Daly, Bronson Howard, Herne, Belasco, Clyde Fitch, Augustus Thomas, Eugene Walter, George M. Cohan and Edward Sheldon, many of whose plays were acted abroad. Latterly, the old order has been reversed, and America sends at least as many of its dramas to England as England does to America. EUGENE O'NEILL is recognized as a dramatist of international importance and probably represents the highest peak of the AMERICAN DRAMA.

BIBLIOGRAPHY.—Aristotle, *Poetics*; J. L. Klein, *Geschichte des Dramas*, 1865-86; E. K. Chambers, *The Medieval Stage*, 1903; *The Elizabethan Stage*, 1923; Brander Matthews, *The Development of the Drama*, 1903; W. Archer, *The Old Drama and the New*, 1923; A. H. Quinn, *A History of the American Drama from the Beginning to the Civil War*, 1923, and *A History of the American Drama from the Civil War to the Present Day*, 1927.

DRAMA, ORIGINS AND FORMS. The sources of the drama lie so deep that a search for its origins

leads into folk psychology and even into metaphysics. In its rudimentary aspects drama is a product of the festival spirit which is closely allied with primitive worship. But the term "drama" is usually applied to a more developed form of activity which calls to its aid the arts of literature, painting and music. The root form of the term means "to act" or "to do." The central art of the drama is therefore that of the actor.

There are at least four strains of developed dramatic art. Although not without common roots, these are in effect independent and consist of the Hindu (see INDIAN DRAMA), the CHINESE, the GREEK (and ROMAN) and the MEDIEVAL (and Modern) DRAMA. Fortunately, one can follow the development of the drama of the western world from its primitive status to its most highly articulated condition. Beginning with dithyrambs and rhapsodies rendered by a chorus, the first step toward drama was taken in the 6th century, B.C., when Thespis isolated the actor from the chorus. In the same century ÆSCHYLUS added the second actor, and in the next century SOPHOCLES added the third. The last step was taken in Roman times when the chorus disappeared and drama became a matter of acting only.

The development of medieval and modern drama is practically an independent phenomenon. Appearing simultaneously in western Europe between the 11th and the 15th centuries it began in the church, but soon became isolated. Medieval drama never had the regularity of form or content of the classic drama, and from the start mingled serious and comic strains. Roughly, the MYSTERY PLAYS dealt with Scriptural events, the Miracle Plays with legends of the Church, the MORALITIES with an allegorical action of personified virtues and vices. When the abstract characters of the moralities solidified into the real characters of the CHRONICLE PLAY and the INTERLUDE, modern drama was born. It was from this group that the romantic drama of England and Spain developed.

But the history of modern drama is complicated by the fact that during the Renaissance there came a revival of classic forms which for many years dominated the stages of the courts and universities. From these types came the regular tragedy and comedy of PIERRE CORNEILLE and MOLIÈRE, as well as such derivative forms as masked comedy, OPERA, PASTORALS and the MASQUE. And it was in connection with the plays written in the classical manner that most of the doctrines and rules of theoretical dramaturgy were developed. Regular TRAGEDY and COMEDY adapted itself well to the speculations and generalizations of the theorist. Therefore, to this day the terminology and the criteria of dramatic criticism are based largely on a form of drama no longer practiced. This may mean that dramatic theory has had no second ARISTOTLE. It may also mean that Aristotle himself might have lost his way in the mazes of modern play-writing.

In the two thousand years from Thespis to the Renaissance the progress of drama had been from the general to the particular, from the divine to the vulgar. EURIPIDES had brought the drama from the gods

to man. In the modern theater this tendency was to be pushed further. In the 16th century prose was introduced to the stage of the serious drama. In the 18th century Lillo, Lessing, Diderot and Beaumarchais (see separate articles on these writers) were to introduce into the drama the passions of common men, a social conscience and something of political potency. In the 19th century Victor Hugo defined ROMANTICISM as "liberalism in literature." From an adjunct first of the altar and then of the court the theater was becoming the tribune of the people. Here one finds an explanation of the types of plays that in modern times have been written to please the people and to express their motives and moods. Among these types are some which derive from the classic forms by a rewriting of their rules, such as TRAGI-COMEDY, heroic tragedy, Restoration comedy; some apply the cooling hand of sensibility and strict propriety to an art that had become too exuberant, such as sentimental comedy, (*la Comédie larmoyante*); some turn away from kings and nobles to find drama in the lives of common men; some carry the warmth of the Romantic play into extremes of passion and declamation, as in tragedy and MELODRAMA; finally some are written simply for the lightest entertainment, such as the vaudeville.

The laws of dramatic composition belong to universal practice, and this goes back to principles of psychology. But it was the Greeks who gave these laws expression. Aristotle rested on the essential differentiation of the tragic and the comic, and the arrangement of the matter of the play according to the dictates of unity, completeness and rising and falling action. (See DRAMATIC UNITIES.) Even by the Romans the rigor of the Greek rules was much relaxed. Later times have shown an almost limitless ingenuity in attempting to adapt the elementary truisms of Aristotle to the demands of later audiences and the practice of later playwrights. Among those who have added their speculations to dramatic theory are Horace, Castelvetro, Lope de Vega, Dryden, Lessing, Diderot, Beaumarchais, Schlegel, Hugo, Brunetière, Maeterlinck and Strindberg. For modern times it is safe to say that the strict differentiation between tragedy and comedy has been discarded. Dramas now tend to fall roughly into two general types, the symbolic and the realistic, depending on whether the author treats his material by means of the symbols of free imagination or the more restrained symbols of observation and reason. T.H.D.

BIBLIOGRAPHY.—Frazier, *The Golden Bough*; S. Cheney, *The Theater*; Schlegel, *Lectures on Dramatic Art and Literature*; Mantzius, *History of Theatrical Art in Ancient and Modern Times*; B. H. Clark, *European Theories of the Drama*, 1918.

DRAMA, a town in Greek Macedonia, seat of the nomarchy of the same name. Until 1912 part of European Turkey and included in the vilayet of Salonika, it passed into Greek hands during the Balkan War and formed part of the disputed territory which Bulgaria claimed and which precipitated the second Balkan War. The celebrated Macedonian tobacco-growing in the district is the chief trade of the town. In recent years there have been repeated labor dis-

turbances among the tobacco workers. In the environs of Drama was located the capital of Philip of Macedonia and a few miles to the southeast lies the plain of Philippi on which Brutus and Cassius were defeated in 42 B.C. Pop. 1928, 29,339.

DRAMATIC CRITICISM. There exists a notion that dramatic criticism as distinguished from dramatic history or the esthetic discussion of drama is a relatively recent development; certainly the periodical criticism of acted plays can hardly be said to have existed before the 18th century. In the broadest sense of the terms, dramatic criticism in Europe began, so far as is known, with the Greek philosopher ARISTOTLE (384-322 B.C.), whose treatise, *The Poetics*, is the most influential and remains probably the most enlightened treatise on the drama ever written; but aside from the later Scholia, or commentaries on Greek drama concerned mainly with linguistic details, Greek literature has almost nothing to add to the subject. In ancient Rome the only important writers who had much to say on the drama or the theater were CICERO, HORACE and QUINTILIAN. During the Renaissance, particularly in Italy, there was a vast amount of writing on the subject, but most of it was pedantic and confined to a discussion of Aristotle, Horace and the "Rules." In Spain and Germany and Holland a similar situation existed, except that there were fewer writers there than in France and Italy. In France, especially in the late 16th century, there were indications of a freer and less pedantic spirit, though as yet nothing of modern criticism of the regular periodical sort.

The Renaissance spirit in England was exemplified—so far as dramatic commentary was concerned—in SIR PHILIP SIDNEY (1554-86), whose classic viewpoint was almost entirely ignored by SHAKESPEARE (1564-1616) and the other dramatists. Though BEN JONSON (1574-1637) exhibited originality of a kind in his *Timber*, the Elizabethans made no marked contribution to the subject, while JOHN DRYDEN (1631-1700) was in certain respects the founder of modern criticism, his work was limited almost entirely to a discussion of the fundamentals.

With the 18th century, however, and the rise of the literary periodical, one has the first dramatic criticism, appearing more or less regularly, dealing with individual performances. In England, as in France and Germany, the reviewer began to specialize in plays, especially plays that were performed, though much of the periodical criticism was to a great extent philosophical and of a general character.

The most important contribution to periodical dramatic criticism in the 18th century was the German Lessing's *Hamburgische Dramaturgie*, 1769. In France more or less similar work was carried on by VOLTAIRE, DIDEROT and La Harpe, and in England by ADDISON and SAMUEL JOHNSON.

Not until the 19th century, however, were writers entirely dedicated to the writing of regular dramatic reviews. During the first half of the century in France, Jules Janin, St. Marc Girardin and Théophile Gautier exerted widespread influence, while in the

second half, Francisque Sarcey was probably the first and by all odds the most eminent writer exclusively functioning as a dramatic critic.

The 19th century in England began with CHARLES LAMB, LEIGH HUNT, and WILLIAM HAZLITT, and ended with DUTTON COOK, CLEMENT SCOTT, WILLIAM ARCHER and BERNARD SHAW. Elsewhere—especially in Germany, the United States, Italy and the Scandinavian countries—a similar state of affairs existed.

Dramatic criticism appears to be firmly established as a part of daily journalism, historical writing on the subject being confined to the more conservative weekly and monthly journals. B. H. C.

BIBLIOGRAPHY.—George Saintsbury, *A History of Criticism*, 3 vols.; Allardyce Nicoll, *The Theory of Drama*; Barrett H. Clark, *European Theories of the Drama*.

DRAMATICS IN SCHOOLS AND COLLEGES. See EDUCATIONAL DRAMATICS; THEATER SCHOOLS.

DRAMATIC THEORY. Every group, nation, or race that has produced drama has likewise contributed its theories on drama. In its simplest form a dramatic theory is a statement, usually made by a critic or playwright, setting forth either how plays have been, or how they should be made, or both. Almost invariably the plays preceded the theory, although dramatic history shows that for over 2,000 years playwrights have striven to conform to the theories that appealed to them or were the most fashionable at the time.

It would be possible to trace the evolution of dramatic theory in the annals of even the least important chapters of history, but for the present purpose it is enough to state that outside western Europe and the three Oriental countries, India, China and Japan, which have made any considerable addition to the world's store of dramatic literature, there is very little of importance; and of the two, Europe's contribution is by far the more extensive, interesting and influential. In China and Japan where, during the epoch roughly speaking between 1300 and 1800, the writing and production of plays were more or less regulated by religious and social tradition, there was relatively little written on the subject of theory: the "Rules" were more likely to be evolved and handed on orally than in learned treatises. The same thing is largely true of the Sanskrit drama, which presumably began in India shortly after the time of Christ and reached its apex about a thousand years later. Of the many exhaustive treatises on drama of which there is some knowledge one or two of outstanding importance have survived: the *Natyashastra*, which possibly belongs to the 4th century, and the *Daçarupa*, probably of the 10th century.

But by all odds the most important and influential writing on dramatic theory in the world is the fragmentary *Poetics* of the Greek philosopher, ARISTOTLE (384-322 B.C.). This relatively short treatise may have been only a series of lecture notes; it was certainly not intended as a dogmatic system of rules.

Though little information exists as to its effect on the drama of antiquity, the mass of commentary on it from the 16th century onward is amazing. The Greek text, first printed in Italy in 1508, was during the next century edited, translated, expounded and, before long, firmly entrenched with all the authority of scripture, and for nearly 300 years—with a few notable exceptions—accepted by playwrights as an infallible guide.

Next in importance to the *Poetics* is the so-called *Art of Poetry*, 24-20 B.C., of the Latin poet, HORACE, a more formal and finished work, but less original; yet this has continued throughout the centuries to be reprinted and discussed. In spite of the many commentaries on both these works during the Renaissance, very little of value was added to the body of dramatic theory until later times, though the dissenting voices of LOPE DE VEGA (1562-1635) and MOLIÈRE (1622-73) indicated a wholesome attitude of reaction against the deadening Rules. Not until the 17th century did any writer add materially to the world's store of reasoned and intelligent doctrine; modern philosophic criticism of the drama may be said to have begun with the various essays of JOHN DRYDEN (1631-1700), although the next great English critic did not appear until S. T. COLERIDGE delivered his lectures on Shakespeare nearly 200 years later.

In France the current, in spite of Molière and a few minor dissenters, was largely classic until the 19th century when VICTOR HUGO (1802-85) proclaimed a new form and a new conception of drama in his epoch-making preface to *Cromwell*. In Germany the modern drama and dramatic criticism were begun almost simultaneously by G. E. LESSING (1729-81) toward the middle of the 18th century.

There was no lack of intelligent discussion of dramatic theory in most European countries during the 19th century, most of it, until the middle of the century, being the outgrowth of discussion of the ideas of the French writers, DENIS DIDEROT and VOLTAIRE, and the Germans LESSING and F. VON SCHILLER; but as soon as the scientific theory of Evolution had become popularized, it was applied more or less to the art of drama, particularly by the French critic, FERDINAND BRUNETIÈRE (1849-1906).

Since about 1880 has appeared what seems to be an almost total independence of any one fundamental theory, and hundreds of writers have advanced, with greater or less skill and intelligence, a large number of theories to explain and guide the newer playwrights of all lands. Among the most influential and interesting of these writers are MAURICE MAETERLINCK and GORDON CRAIG.

It may be said that the tendency is away from rules of any sort: the playwright of genius will write as he sees fit, and his success is due not to any theory followed by him but to the truth as he sees it. See also DRAMA; DRAMATIC CRITICISM. B. H. C.

BIBLIOGRAPHY.—Barrett H. Clark, *European Theories of the Drama*, 1918; Allardyce Nicoll, *Introduction to Dramatic Theory*, 1923.

DRAMATIC UNITIES, classical rules of play construction, originally but mistakenly thought to come from Aristotle's *Poetics*. Called the unities of time, place and action, they restrict the time considered in a play to a single day, the scene of action to a single place and the incidents to those revolving about a single plot. The rules grew out of the construction of the Greek stage and the limitations imposed on a drama in which the division into acts was defined only by the use of a chorus, which was present throughout the play. Through the Roman tragedist **SENECA**, the unities were transmitted to Europe during the Renaissance to be adopted in their entirety by the French classicists, **PIERRE CORNEILLE** and **JEAN RACINE**, and by many playwrights in England, notably **BEN JONSON**. **SHAKESPEARE** commonly ignored the unities of time and place and at times even had two plots with only the slightest connection in the same play. Since his time the unity of action is alone regarded as strictly necessary, especially to-day when scenery is used to give an illusion of place, while the curtain and program allow for elapse of time. See also **DRAMA**.

DRAMMEN, a port of Norway in the district of Buskerud, situated at the northern end of the Drammens Fjord, a western branch of the Oslo Fjord. Its huge supplies of lumber and large sawmills make it the center of the Norwegian lumber trade. Besides woodpulp and paper factories, there are shipyards, breweries and cotton mills. The port's large merchant fleet is engaged mainly in commerce with England and Holland, and a regular steamship service connects with **OSLO**. After the fires of 1866 and 1870, the city was rebuilt and improved. Pop. 1930, 25,399.

DRANG NACH OSTEN. This phrase, *push toward the east*, is commonly applied to two entirely dissimilar developments: first, the medieval expansion of the Germans into the east beginning with Henry the Lion, and second, the 19th and early 20th century commercial rivalry between Austria and Germany on the one hand, and France and Great Britain on the other in the Balkans and the Levant. German policy was successful in attaching Turkey as an ally, but her scheme of commercial expansion, based upon a German controlled railway to be built from Constantinople to Bagdad, in opposition to British and Russian expansion into Persia, was not completed before the outbreak of the World War.

DRAPER, ANDREW SLOAN (1848-1913), American educator, was born at Westford, N.Y., June 21, 1848. Graduating from the Albany Law School in 1871, he practised in Albany until 1885. From 1885-86 he was on the Court of Commissioners of Alabama Claims. Draper was a member of the Albany Board of Education from 1879-81 and in 1886 turned his interests wholly to the educational field. He was New York State Superintendent of Public Instruction 1886-92 and superintendent of instruction of Cleveland, O., schools 1892-94. For the next 10 years he was president of the University of Illinois.

In 1904 he was made the first Commissioner of Education for the State of New York continuing in this office until his death at Albany, N.Y., April 27, 1913.

DRAPERIES, ornamental fabrics used as hangings for walls, dressings for windows and coverings for furniture. Drapery was first used in the East, centuries ago, when merchants in Oriental bazaars made an artful display of textiles to attract customers. The relieving of barren walls by decorative hangings was not begun in Western Europe until the 12th century. About this time soldiers returning from the Crusades brought with them some of the luxuries of the East, and drapery fabrics were among these importations. Hangings grew in popularity, and continued to hold their place of supremacy as wall coverings even after the frescoing of walls was introduced in the 16th century.

The development of window drapery is comparatively recent. Long after yards of rich materials had been draped wherever drapery could be placed, windows continued to be bare. The glass of the Renaissance period was an imperfect, nearly opaque product, and curtains for privacy were not necessary. With the development of larger windows in the 17th century, a style of **CURTAIN** was introduced. Silks, brocades and velvets, which had formed a lavish decoration for walls, were used at windows. About this time light muslins began to be imported from India, and the first cotton curtains resulted, with silken material draped on either side. In France different styles of window drapery were developed. The formal *lambrequin* was used in the time of Louis XIV; a careless informal richness was the style of Louis XV; and more classic lines with less material and lighter-weight silks were adopted under Louis XVI. Chintzes and cretonnes became popular window dressings at this time and their use has never been discontinued in England.

The modern mode of decoration has caused the elimination of many of the elaborate details of the French styles of the 17th and 18th centuries. This is particularly true in the case of the many-tasseled fringes and the much-figured gallons. In the desire to preserve light, thin fabrics have come to be preferred to thick and linings are often omitted. The development of artificial silk fabrics has made interesting and artistic window treatments relatively inexpensive. The draping and curtaining of beds, with the baldaquins, canopies, testers and curtains once so important, has been almost wholly discarded. Beds were curtained not only because of the cold, but to give prominence to what was considered the most important article of furniture. Bed drapery reached its peak in England and France in the 18th century, when beds were enclosed with festoons of drapery, of velvet, damask or satin, rich in decoration and sometimes jeweled.

DRAVE, or **DRAVA**, a river of Yugoslavia, a principal affluent of the **DANUBE**. It rises in the Tirol, below Innichner Eck, at an altitude of 4,000 ft., and runs eastward, almost parallel to the Save. It forms

a long valley in the Alps, which was the chief route through which Slavs, Huns, Turks and other ancient peoples invaded the Alpine lands. The river flows on through Carinthia and Styria and forms the boundary between Hungary and Yugoslavia from Varazdin to Osijek. At Maribor or Marburg it is joined by its chief affluent, the Mur. The Drave reaches the Danube about 14 mi. east of Eszek, not far from the Hungarian boundary. Here at the mouth it reaches a depth of 20 ft. and a breadth of over 1,000 ft. The length of the Drave is 450 mi. and it is navigable by small craft for over 300 mi. River steamers can navigate safely only 100 mi. from its mouth.

DRAVIDIAN, a distinct LINGUISTIC FAMILY spoken in Southern India (Canarese, Malayalam, Tamil and Telugu) by wild tribes in Central India (Gonds, Kus—also called Khonds or Khandhs—and Kurukhs or Oraons) numbering in all a little over 2,000,000; and by 180,000 Brahuis in the hills of eastern Baluchistan, where their location presents an interesting problem which still awaits solution.

All Dravidian languages have borrowed many words from the Indian vocabulary and, on the other hand, their influence has been detected in Indian, including SANSKRIT. Like MUNDA, they share "cerebral" or "retroflex" consonants with Indian, from which Dravidian differs in having both long and short *e* and *o*, as well as spirant consonants. They have no adjective and no relative pronoun; and the verb lacks both mood and voice. The words are polysyllabic and are formed by suffixes only, prefixes and infixes being unknown. Distinction between masculine and feminine GENDER is rare, the normal division being between "higher" and "lower" nouns, the former including gods and men, and the latter beasts and things, while the classification of women varies according to the particular language concerned. There is a special negative verb, which is sometimes marked only by absence of any tense-suffix.

The northern dialects have neither literature nor script of their own; the southern possess alphabets derived from early forms of those used for Sanskrit

J. B.

BIBLIOGRAPHY.—R. Caldwell, *A Comparative Grammar of the Dravidian or South-Indian Family of Languages*, 2d ed., 1875, G. A. Gnerston, *Linguistic Survey of India*, IV, 277-681, 1906, J. Bloch, "Langues dravidiennes," in A. Meillet and M. Cohen, *Les Langues du monde*, 1924, pp. 345-359.

DRAVIDIANS, the most important of the pre-Aryan peoples of India, occupying a region in the peninsular portion extending roughly from the Vindhya Mountains south to Cape Cormorin and bounded on the east and west by the Ghat Mountains. They have been much affected by Indo-Aryans and Mongolians but the pure Dravidian has a black skin, is short and squat in stature, with a long head and broad almost negroid nose. That they preceded the Aryans as inhabitants of India is attested by their present geographical distribution and their distinctive languages belonging to the Tamil family. They are regarded by some authorities as an indigenous people of the Deccan though others argue that they are

related to the natives of Australia or that they came into India through the northwest mountain passages from the Mediterranean region. Dravidian tribes are Tamil, Malayalam, Kanarese, Tulu, Kodagu, Toda, Kota, Kuru, Malto, Gondi, Kui, Telugu, and Brahui.

DRAWBACK, a rebate of taxes previously levied, either import duties (*see* CUSTOMS DUTIES) or INTERNAL REVENUE, or when excisable or imported goods are exported. Drawbacks were introduced to make possible the sale of exported goods at prices on a par with those of similar products from countries where they are not taxed. In the United States drawbacks are allowed when imported goods are exported and when products made by combining imported goods with home goods are exported. The latter is in effect only when the imported materials represent more than half the value of the goods, as is the case with firearms made of imported steel parts but with domestic stocks. *See* BONDED WAREHOUSE; REBATE; ENTREPÔT.

DRAWBRIDGE, a type of bridge which permits the passage of tall vessels. It revolves horizontally on rollers set on a central pier, to a position parallel to the boat channel, thus providing a clear opening on either side. In the *lift* bridge one truss span is lifted vertically between towers to give a limited overhead clearance. *See also* BASCULE BRIDGE; BRIDGES.

DRAWING. *See* CHARCOAL DRAWING; CRAYON DRAWING; DRY-POINT; LINE DRAWING; PENCIL DRAWING; PEN DRAWING; WASH DRAWING; WASHED-OUT OR WIPE-OUT DRAWINGS.

DRAWING, the textile manufacturing process by which untwisted or slightly twisted strands of parallel fibers are placed side by side and so drafted (drawn out) as to develop one strand weighing the same as, or somewhat less than, any one of the original strands. In cotton drawing, for example, six strands are frequently drafted to one-sixth the weight of the total or, in other words, to the weight of one of the original strands. This combining or "doubling," as it is called, no matter how many strands are put together, serves to produce a strand which is more even in diameter and weight than any from which it is made, the principle on which this result is attained being the law of averages. A further and important object of drawing, particularly in the case of worsted drawing, is to reduce the strand to a size suitable for the SPINNING process. Drafting is accomplished mainly by passing the material through several pairs of rollers, of which the last are revolving more rapidly than the first. Those worsted drawing machines known as gill boxes and porcupines exert a combing action, but without removing any fibers. Drawing always aids in straightening the fibers.

E. D. F.

DRAWING, ENGINEERING. *See* ENGINEERING DRAWING.

DRAYTON, MICHAEL (1563-1631), English poet, was born in 1563 at Hartshill, Warwickshire. About 1590 he settled in London and began writing poems. His first volume, *The Harmony of the*

Church, a metrical rendering of parts of the Bible, was condemned by the authorities and all but a few copies were confiscated. The poet's great work, completed in 1622, is *Poly-Olbion*, a poem in 30 parts celebrating the topographical and historical places of interest in England. Of all Drayton's works criticism gives its highest award to *Nymphidia, the Court of Faery*, because of its delicate beauty. Drayton wrote several historical poems, among them *Legend of Piers Gaveston*, *The Barons' Wars*, *England's Heroical Epistles*, and many legends, eclogues, sonnets and pastorals. His famous *Ballad of Agincourt*, an impressive martial poem, is included in his volume, *Poems Lyric and Pastoral*, published 1606. Drayton died in London in 1631, and was buried in Westminster Abbey.

DREADNOUGHT. The dreadnought of the present day is, in reality, the battleship. It represents the most powerful and outstanding surface ship, due to its ability to keep the sea and to its offensive and defensive qualities. Its offensive power is due to the caliber and range of its guns (see *ARTILLERY*) and steadiness of gun platform, while its defensive ability lies in armor protection, torpedo protection, and protection against aircraft and submarines. Many vessels, particularly of smaller size, have greater speed, but to gain this advantage they must give up some other important asset. The battleship has come to us by successive changes from a ship of the line of the sailing ship era. There has been a progressive increase in displacement and in power, notwithstanding the fact that it has often been claimed that ships of this class would be rendered obsolete.

The ram, instituted early in the nineties by other nations, was tried by the United States in the form of the *Katahdin* in 1894, but it did not prove successful. The development of the torpedo and the torpedo boat was the next offensive threat, and that called for the DESTROYER. After it became destroyer versus destroyer, the light CRUISER was developed. Following the use of so-called torpedo nets, for protection fast light cruisers were introduced and nets were abandoned. Then came the submarine, and, finally, the airplane. But for every offensive weapon initiated, the antidote has soon been found.

To defend battleships against torpedoes launched from destroyers and submarines, BLISTERS were fitted to their sides and their compartments were strengthened and increased in number. Next, the secondary batteries of battleships were improved and valuable fire control systems were established. Then the mobility of the battle fleet was increased by the addition of numerous destroyers. Finally, the sea-borne airplane (see *AIRCRAFT CARRIER*) provided a new type of weapon but the anti-aircraft gun has served to nullify its effectiveness.

By the Washington Limitation of Arms Conference (see *WASHINGTON CONFERENCE*) battleships are limited to 35,000 tons. R. E. C.

DREAM-BOOKS, books giving the meanings in terms of future events as betokened by the objects and

actions commonly dreamed of. Fortune-telling by the interpretation of dreams is an ancient art that has come down through folk-lore channels, along with other fortune-telling devices. The dreams are interpreted by weak analogies similar to those that obtain in *SUPERSTITION*. Thus dreams of ascending a ladder portend good luck, of descending, bad luck. Fanciful elaboration by strained interpretation of symbols, and arbitrary assignments in accord with popular beliefs make up the rest, together with such consolatory logic as that dreams go by contraries. For the psychological interpretation see *DREAMS, PSYCHOLOGY OF*.

DREAMS. There are at the present time, two main approaches to the study of dreams; namely, the psychoanalytic (see *PSYCHOANALYSIS*) and what we may call the eclectic, representing accumulative facts from all sources. In many respects the two methods arrive at the same result.

Dreams operate according to the same laws of stimulation and association as in waking life; every fleeting dream image grows from some cause that has relations with the rest of mental life. Dreams may be presentative or representative in origin. The former occur from stimulation of the senses which are all open during sleep. Even the eye, though closed, presents a continual display of color and light stimuli through what is known as the retinal light when the eyes are closed in the dark. Indeed, this has been called "the stuff that dreams are made of." The other class are called representative dreams because they arise in the same manner as memories, imaginings, or feelings in waking life in accordance with the laws of association. Both classes of dreams differ from waking life in that they take a course of free fancy, dramatic and unrestricted as to correspondence with actual life and mental order.

Frequency of Dreams. The frequency of dreams has been a moot question. It is now generally conceded that we dream all the time that we are asleep. As a proof of this view, we note that inability to report a dream is no proof of the non-existence of the dream. When a person wakes up in the morning and says, "I have not dreamed," that simply means that he does not remember his dreams. Whether or not a dream may be remembered depends upon its coherence, the strength of associational ties, the depth of sleep, the habit of remembering dreams and many other similar conditions. The dreams that we remember come from light or disturbed sleep in the later hours of the night. A second line of evidence for dreamless sleep is found in the theoretical relationship between neural processes and mental processes. The brain is acting night and day, and one aspect of the activity is the subconscious mental life. A third line of evidence comes from experiment. In this, psychoanalysis offers the best examples; but hypnosis and other forms of tapping the subconscious have given abundant evidence to show that under favorable conditions the subject may be led to recall a great variety of dreams after so-called dreamless sleep. A fourth line of support

comes from the observation of activity during sleep. If one observes the sleeper in the same way that the mind reader watches the minute movements of expression which reveal mental activity, good support may be found for the belief that there is an inceptive tendency for dreams to express themselves continuously during sleep.

Characteristics. If we examine the experiences of dream life, we may note certain characteristics. The dream is a perfect example of the subconscious mental process. The dream is an illusion. All dream life is in the present, hence in the form of perceptions and images which ordinarily do not correspond to fact. The dream is dramatic. It is living action in the present, realistic and free from the limitations of reality. The dream is symbolical. We do not dream in the abstract, but always in the concrete. Even abstract ideas such as beauty and purity are pictured in rich trains of extravagant objects and events. It follows that dream life is a process of gross exaggeration. It would, perhaps, be truer to say that it is the exaggeration of dreams that we remember. Those that are not exaggerated are too common, too frequent to be remembered.

The dream violates laws of time, space and causality. In the absence of the waking censor, self-control, the dream images are free, independent of these three limitations which make experience constant. These concepts all operate in a dream but with dream license. As regards time, the dramatic license of a dream makes everything present, whether it is taken from past, present, future or non-existent. Everything must be in the plot, and the plot is where you are. We do not hesitate to claim new powers such as the ability to fly, to pass instantly from one continent to another, to transcend the bounds of death. However, some dreams present just the opposite condition, a blocking of every effort. These are called "bogy" dreams.

The dream is flashlike. One may dream in a small fraction of a second events which represent hours of performance and long recall. It acts like a flash camera, producing an instantaneous picture of a complicated situation which takes a long time to see in detail consciously. In the dream there is absence of surprise. The dreamer is not surprised at his power to fly, at seeing a dead friend. Nor does he appreciate the ludicrous. One can readily dream of surprise and of ludicrousness; but those situations which in waking life excite those feelings do not normally do so in the dream. In the dream we are our whole nature turned loose as it were, whereas in waking life we tend to be what we wish to seem to be. There is, therefore, a reversion to type in the dream. The dreamer often lives in his childhood nature or in the earlier type of his race. He tends to live "the lower man" with racial strains rather than stages of higher cultural levels. Yet intellectual feats, moral influences, and the motivation of action for waking life are common in the dream regardless of whether a person remembers the dream or not; his waking, intellectual, affective and

cognitive life is modified continually by the dream activity. The suffering in dreams is real suffering and the pleasure is real pleasure. For evidence as to what extent the dream represents a wish fulfillment, a realization of suppressed desires, we must turn to the psychoanalytic theory. (See also PSYCHOANALYSIS.)

Veridicality of Dreams. Do dreams come true? Various answers to this question play an important rôle in the conduct of daily life. Certain premonitions do come true when rightly interpreted. Among these are warnings of a bodily condition, such as disease, coming through dream consciousness. Such premonitions may come in an infinite variety of ways in the environment as well as in the organism and may be due to hypersensibility of dream consciousness. Then there is a variety of classes of dreams which cause their own fulfillment. In these cases the dream acts on the principle of suggestion. However, in general, we may say that the popular notion about veridical dreams is not supported by scientific observation. Most such dreams are classified as coincidences or are due to inadequate report. The studies of spiritism have thrown very interesting light on this aspect of dream life. The greatest significance of the dream lies in its influence on waking life. The subconscious which the dream represents is present as a stratum underlying all waking life.

Sleep-walking is a form of dream action. It usually takes place during the first two hours of the night in the period of deepest sleep. The reason for this is that in the lighter sleep the sleep-walker wakes up, whereas in the deep sleep all kinds of activity, as complicated as in waking life, may be performed and the sleep-walker may return to bed and wake up in the morning without the slightest memory of the performance. This phenomenon furnishes a transitional step from the dream stage to alterations of personality. Many persons walk regularly in their sleep and during these periods exhibit an entirely different personality from that of waking life. See also ABNORMAL PSYCHOLOGY.

C. E. S.

BIBLIOGRAPHY.—H. L. Hollingsworth, *The Psychology of Thought Approached through Studies of Sleeping and Dreaming*; C. W. Valentine, *Dreams and the Unconscious, an Introduction to the Study of Psychoanalysis*.

DREDGES, appliances, usually floating, for excavating wholly or partly under water. In operation, steel posts or "spuds" are forced into the bottom of the body of water to hold the dredge in position. The principal types of dredges are: 1. *Grab or Grapple*, wherein the excavating tool is a "clam-shell" or "orange peel" bucket operated by lines from a boom; 2. *Dipper*, where the excavating tool is a dipper or scoop on an arm or "stick," operated on a boom similar to the familiar land power-shovel; 3. *Ladder*, whereby excavation is accomplished by buckets on an endless chain operating on an adjustable "ladder"; 4. *Suction or Hydraulic*, where excavation is accomplished through a suction pipe, usually mounted on an adjustable "ladder" and provided with a revolving "cutter" to break up the soil.

With grab, dipper and ladder dredges, excavated

material is usually deposited in dump scows and disposed of from them. Hydraulic dredges may have a discharge pipe line for pumping the mixture of earth and water to another location or, in the case of sea-going dredges, may be provided with a "hopper," the contents of which may be dumped after moving the dredge.

The fields of usefulness of the various types overlap somewhat, but, in general, each has a sphere in which it is most efficient. *Grab* dredges are flexible tools, suited to a variety of work, but are particularly efficient for small operations in relatively soft material or for re-dredging. *Dipper* dredges are particularly suitable for excavating hard earth, and soft or blasted rock. *Suction* dredges are most efficient in large operations, particularly in soft materials and where filling operations are involved. When specially designed and equipped with proper cutters, ladders and operating machinery, suction dredges operate efficiently in hard materials, including some soft rocks. Sea-going dredges are adapted to work on entrance channels and ocean bars. Ladder dredges, widely used only in Europe, are capable of excavating a wide range of materials. F. R. H.

DRED SCOTT CASE, a suit which led to a decision of the United States Supreme Court of great significance in the slavery controversy. Dred Scott, a slave owned by a resident of Missouri, had in 1834 been taken into Illinois, where slavery was prohibited by the state constitution, and in 1836 into Minnesota, a part of the Louisiana Purchase, in which slavery was expressly prohibited by the **MISSOURI COMPROMISE**; in 1838 he was returned to Missouri. In 1848 he sued for his freedom, chiefly upon the contention that through residence in free territory he had acquired the status of a freeman; the Supreme Court of Missouri denied his contention in 1852. In that year Scott was sold to a citizen of New York, and transferred his suit to the Federal courts. On appeal from the Circuit Court, the case was argued at length before the Supreme Court in 1855 and 1856. The highest court was about to render its verdict that the Circuit Court had erred in entertaining the suit because Scott was not a citizen and therefore without standing in the courts, when for obscure reasons, perhaps the desire of Justice Curtis to prepare a vigorous dissenting opinion which should increase his political prestige, the decision was withheld for several months, until Mar. 6, 1857. Chief Justice Taney then delivered his elaborated decision, proceeding beyond the simple issue of jurisdiction to declare the Missouri Compromise unconstitutional, as an abridgement of the right of property. The decision aroused angry dissent in the North, clarified the issues to be decided in the impending war, and added weight to the contention of the South that the duty of Congress was to protect slavery in the territories.

DREISER, THEODORE (1871-), American novelist, was born at Terre Haute, Ind., Aug. 27, 1871. His education in the public schools was followed by a brief period in the University of Indiana,

after which he did newspaper work in various cities and edited magazines in New York City. He was editor-in-chief of the Butterick Publications for 3 years, resigning in 1910 to devote himself to writing. His first novel, *Sister Carrie*, was suppressed soon after it appeared in 1900, but on its republication a year or two later won high praise. Among his later novels are *Jennie Gerhardt*, 1911, *The Financier*, 1912, *The Titan*, 1914, *The Genius*, 1915, and *An American Tragedy*, 1925, a long story based on an actual crime, which has been successfully dramatized and made into a moving picture. Among his other works are several volumes of short stories, *Moods*, a book of verse, 1926, *A Gallery of Women*, 1929, and the autobiographical *Dawn*, 1931. Dreiser is an important figure in the American school of extreme realists. His style is unpolished and often clumsy, but he is a keen observer and builds a vast quantity of minute details into a solid, impressive, generally tragic story.

DRESDEN, capital of the German free state of Saxony, the second largest Saxon city, situated on both banks of the Elbe River about 62 mi. east and south of Leipzig. It is favored by a mild climate and an attractive landscape, being surrounded by hills. On account of its site and of its wealth in works of art, it is called the "Elbe-Florence."

South of the river is Dresden-Altstadt, which, with several former suburbs and with Dresden-Neustadt across the river, now form the business section. Residential districts adjoin and surround the Altstadt and Neustadt. Further downstream is the Leipziger Vorstadt, the chief industrial section. The finest residential section surrounds the Grosser Garten. Six bridges span the river. Dresden owes its wealth in splendid buildings and art treasures to the munificence of its former rulers. The most noteworthy buildings, in Italian Baroque, occupy less than a square mile on the south bank of the river and include the Brühl'sche Terrace and the Academy of Fine Arts. Nearby is the famous Frauenkirche, whose towering dome dominates the skyline, and the Johanneum, now containing the Historical Museum and other collections. The former royal palace, dating back to ancient times, was enlarged to four times its previous size in the 16th century and restored in 1889-1901. The treasures of the royal family are still to be seen in the west wing. United to the palace is the former Catholic Court Church in Italian Baroque, 1638-55. On the other side of the palace is the Protestant Court Church, the only medieval church in Dresden. Opposite these buildings is the famous Zwinger, also in beautiful Baroque, a large court surrounded by arcades uniting the various buildings, which now contain miscellaneous collections. The northeast Renaissance edifice, built in the 19th century, houses the great art gallery, whose chief treasure is the *Sistine Madonna* by RAPHAEL.

The city embraces large areas given over to parks traversing large sections and skirting its limits. In the Altstadt is the Grosser Garten, with Zoological

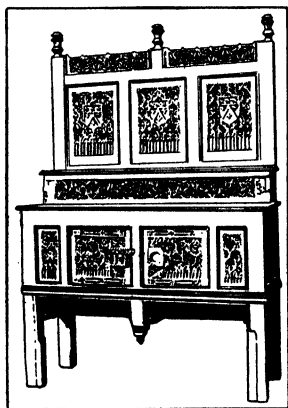
Garden, Museum-Palace, concert house, Botanical Garden and magnificent old trees. A short distance from the center of the city is the Burgerwiese Park, with many statues, monuments and fountains. There are also many parks in most parts of the city and in the suburbs.

Though Dresden still has the aspect of an aristocratic residential city, it is, nevertheless, an important industrial center. The city fathers have seen to it that the factories were erected beyond the outskirts of Dresden, so that its character as a cultural and tourist center might remain intact. The coal nearby gave impetus to manufactures and there were 8,300 plants in 1928. The oldest and largest branch is the cigarette industry, the city being the central market for Greek and Turkish raw tobacco.

Dresden is an important railroad center on main lines in all directions, and air lines connect with foreign countries as well as with important German cities. There is heavy shipping on the Elbe from Bohemia to Hamburg.

Dresden has a technical university of note, theaters where some of the world's leading operas are held, music and art schools, a hygienic academy and many boarding, technical and vocational schools.

Dresden was originally a Slavic fishing village, near which the Margrave of Meissen built a fortress. A city grew up around it in the 13th century. The sovereigns built up the city and furthered commerce and industry. Under Augustus I and Augustus II, who were also kings of Poland, it became one of the most splendid courts of Europe with its ornate background of sumptuous Baroque and rococo buildings and settings. Pop. 1925, 619,157.



COURTESY M. M. OF ART
FRENCH DRESSER OF CARVED WALNUT,
LATE 15TH CENTURY

DRESSER (French, *dressoir*), a combination of cupboard and table with doors or drawers below, and with or without one or more shelves above, used for displaying dishes and utensils and for the prepara-

tion of food. Some have high legs, others no legs at all. Some are built into the wainscoting. During the Gothic period the dresser became the most conspicuous and elaborately decorated piece of furniture in the great hall; it was sometimes 20 ft. long, and on it the most precious vessels and dishes of the household were displayed. In the Netherlands custom allowed four or five shelves for royalty, three for nobility and two for the commoner. The dresser of Louis XIV was made of silver, which the king eventually melted and cast into coin for his wars. Evolved from the Italian *CREDENZA* or credence table, which in turn was evolved from the *CHEST*, the dresser has developed into the modern sideboard. The name dresser is given also to a piece of kitchen furniture of similar construction.

DREW FAMILY, a prominent theatrical group on the American stage. John Drew (1827-62), American comedian, was born at Dublin, Ireland, Sept. 3, 1827. His first American stage appearance was at the Richmond Hill Theatre, New York City, in 1842. In 1850 he married Louisa Lane; the issue of this union was John Drew, Georgiana Drew (Mrs. Maurice Barrymore) and Louisa Drew (Mrs. Charles Mendum), who died in 1894. In 1853 the elder Drew became lessee, with William Wheatley, of the Arch St. Theatre, Philadelphia, Pa. He was noted for his Irish characterizations, and toured extensively, appearing at the Lyceum, London, in 1860, as Handy Andy. He died at Philadelphia, Pa., May 21, 1862.

Mrs. John Drew (Louisa Lane) (1820-97), American actress, was born at London, Jan. 10, 1820, daughter of Thomas Fred Lane, English actor. She came to America with her widowed mother (afterward Mrs. Kinloch) in 1827, when she played the Duke of York to the elder Booth's *Richard III*, and Albert to Edwin Forrest's *William Tell*. One of her triumphs was in *Fortunio* at the Park Theatre, New York. In 1861 she became lessee and manager of the Arch St. Theatre, Philadelphia, Pa., and retained it for 31 years. She played Mrs. Malaprop with JOSEPH JEFFERSON in 1880-92, and subsequently starred under the management of her adopted son, Sidney (White) Drew. She died at Larchmont, N.Y., Aug. 31, 1897.

John Drew (1853-1927), son of the senior Drews, was born at Philadelphia, Pa., Nov. 13, 1853. He began his theatrical career under the direction of his mother, Louisa Lane Drew, at the Arch Street Theatre, in Philadelphia, appearing there on Mar. 22, 1873, in *Cool As a Cucumber*. In 1875 he joined Daly's company, and appeared frequently thereafter in Shakespearean rôles, and as the lead in notable productions of *The School for Scandal*, *The Taming of the Shrew*, *Richard Carvel*, *The Circle* and *Trelawney of the Wells*. He died at San Francisco, Calif., July 9, 1927. In 1922 he published his memoirs, *My Years on the Stage*.

Georgiana Drew (Mrs. Maurice Barrymore) (1856-93), American actress, was born in 1856 and educated in Philadelphia, Pa. She made her first appearance

in 1872 at the Arch Street Theatre, Philadelphia, managed by her mother, in *The Ladies' Battle*. After her brother John Drew's engagement by AUGUSTIN DALY she followed him into the company in 1876. The same year she was married to Maurice Barrymore (see BARRYMORE FAMILY) and toured with him, also playing opposite EDWIN BOOTH, LAURENCE BARRETT and John McCullough. She made her last appearance in Boston, Mass., Oct. 17, 1872, and died in Santa Barbara, Calif., July 2, 1893. She was noted for her wit, and was at her best in comedy.

Sidney (White) Drew (1864-1919), American comedian, adopted son of Mrs. John Drew, was born at Philadelphia, Pa., in 1864. He was educated at the University of Pennsylvania. An opportunity to play the rôle of Clarence Dexter in *Her Boarding House* led him to adopt a stage career. He appeared successfully in *A Legal Wick*, 1888. Drew will be remembered for the remarkably sincere and wholesome comedies which he and his second wife, Lucille McVey, as Henry and Polly, produced in motion-pictures. He died at New York, Apr. 9, 1919.

DREXEL, ANTHONY J. (1826-93), American philanthropist, was born in Philadelphia, Sept. 13, 1826. At 13 he entered his father's brokerage office and at 21 became a member of Drexel & Company. As head of the firm after 1863, he dealt judiciously with post-war needs of financing national and local public debts, and developing industries, expanding his financial operations to San Francisco, New York, London and Paris. With the great wealth which he had acquired Drexel was generous in supporting hospitals, churches and charities and in 1892 founded Drexel Institute in Philadelphia to promote industrial education. He died at Carlsbad, Germany, June 30, 1893.

DREXEL INSTITUTE OF ART, SCIENCE AND INDUSTRY, a technological, non-sectarian college for men and women, founded at Philadelphia, Pa., by Anthony J. Drexel in 1891. Schools of home economics, business and business administration, and library science are maintained. Both day and night classes are held, and free public lectures are given. The institution has productive funds which amount to \$2,930,676. The library of 40,000 volumes contains the Standish Collection of the Classics and the Jarvis Collection of Musical Scores. There are valuable collections of the ceramic arts, bronzes, ivory carvings, textiles, embroideries and furniture in the museum. In 1931 there were 1,849 students and a faculty of 100. Parke R. Kolbe became president in 1932.

DREYFUS, ALFRED (1859-), French soldier, was born at Mulhouse on Oct. 9, 1859. He studied at the École Polytechnique, was commissioned a lieutenant on his joining the army, and rose to a captaincy in 1889. Having received training at the staff college, he obtained an appointment in the war office. On Oct. 15, 1894 he was arrested because of his suspected complicity in the treasonable act of revealing information to the German military attaché. Before a court-martial he was declared guilty and was

condemned to life imprisonment. He began his detention on Devil's Island in Mar. 1895. From that time until 1906, when Dreyfus's sentence was quashed, the national aspects of the struggle consisted in a struggle between the militaristic faction representing the royalists and the anti-militarists representing the Republicans of the Third Republic. From 1896 to 1906 the case attracted international attention, both because of the party strife in France due to it and the questionable attitude of the military officials toward the real facts of the case, which showed clearly the innocence of Dreyfus and that Esterhazy, another French officer, was guilty of the treasonable act. The cause of Dreyfus was fought mainly by his family, Georges and Albert Clémenceau, and Émile Zola. In 1897 the court acquitted Esterhazy, and Zola published the famous letter *J'accuse*. In 1899 Dreyfus was retried, found guilty and sentenced to ten years' imprisonment, but he was pardoned in the same year and lived in freedom for a time. The case was again before the court in 1903 and after an inquiry which lasted until 1906, Dreyfus was completely absolved, and again took part in military affairs with the rank of major. During the World War he was appointed lieutenant colonel, and afterwards retired to private life.

DRIERS, for paints and varnishes, are metals or their compounds used to accelerate the hardening of drying oils. Driers reduce the drying time of paints from two days to a few hours. Cobalt, manganese, chromium, nickel, iron, platinum, palladium, lead, calcium, barium, bismuth, mercury, uranium, copper, and zinc, or their compounds, aid the drying of LINSEED OIL. The drier acts as a catalyser (see CATALYSIS), adsorbing oxygen from the air and carrying it to the oil. The principal substances used as driers are the oxides or salts of lead, manganese and cobalt. See also PAINT.

DRIERS, MECHANICAL. See DRYING AND DRYING EQUIPMENT; DRYERS, WOOD PRODUCT.

DRIFT, or "glacial drift," refers in general to deposits formed by glaciers. Usually it is restricted to those heterogeneous ones called also BOULDER CLAY and TILL, the term "stratified drift" being used when referring to the stratified glacial deposits, such as outwash plains formed by water originating in the glacier. The name drift came from the idea held during part of the 19th century, particularly by strict adherents to the Noachian Deluge account, that the material was dropped by drifting icebergs when the land was covered with water.

In oceanography, the term, drift, is used to indicate some widespread movement of the surface layers of the oceans, of such general nature as not to possess well-defined boundaries and often not even a distinct direction.

DRIFT, in mining, a horizontal mine passageway driven along the course of a vein. Series of drifts at different levels develop the ore deposit and later serve as main arteries for its removal. See also MINE DEVELOPMENT.

DRIFT INDICATOR, an instrument used in flying to measure the angle between the direction in which the plane is heading and the direction in which it actually flies when its flight is influenced by a wind. The ground is observed through the drift indicator and the instrument is adjusted until its indicating lines are in line with the direction of flight as indicated by the apparent motion of objects on the ground. The angle of drift is then read from a scale marked in degrees.

C. H. C.

DRILLING, in mining, consists in cutting holes into the rock to receive a charge of explosives for blasting purposes. In soft ground, hand drilling is done by means of a pointed bar, auger or spiral rotary drill. In hard rock, drill and hammer are used; the drill consists of a short length of steel ending in a chisel-edge bit. Machine rock drills have almost



FROM H. H. MANCHESTER, ILLUSTRATED HISTORY OF MINING AND METALLURGY, ENGINEERING AND MINING JOURNAL PRESS

ROCK DRILLING IN EGYPT 3,500 YEARS AGO

The foreman at the left uses his prod on the workman's foot

entirely supplanted hand drilling in metal mining. In underground work, compressed air is the motive power; on surface, steam is sometimes employed. There are piston drills and hammer drills; in the hammer type, a light piston actuated by steam or air strikes the end of the drill steel which usually is automatically rotated, except that in some types there is no automatic rotating device. In soft rock, drills of the auger type are frequently employed (see COAL AUGER).

An entirely different kind of drilling, also called boring, consists in the cutting of deep holes of comparatively small diameter, for the purpose of MINE EXPLORATION or as in gas, oil and sulphur, for the extraction of subterranean deposits. Churn drilling, hydraulic rotary drilling, diamond drilling and shot drilling are the principal methods in use.

Churn drilling is a percussion method of boring through rocks, used in prospecting and principally in boring for oil. The equipment consists of a "cutting tool," which ends in a sharp bit, attached to a rope or steel cable, by means of which it is alternately hoisted a few inches and allowed to drop. After a few feet have been drilled, the cuttings are bailed out. Both hand-operated and machine churn drills are used.

Hydraulic rotary drills are used mainly for drilling oil wells. The outfit consists of a heavy line of tubing, to one end of which a bit is attached. Boring is

effected by rotating the pipe by means of a revolving device.

Diamond drills and shot drills have tubular steel bits which are rotated at high speed and cut an annular groove, leaving a core of the material penetrated. The bit is attached to a special tubular piece called a "core barrel," which in turn is connected to a line of hollow steel drill rods extending to the surface. There the rods are connected to a rotating device. The core barrel is brought to the surface at intervals and the core removed so that it can be examined to determine the nature of the rocks being drilled.

Diamond drills use CARBONADOS or BORTZ imbedded in the bit for the abrasive, while shot drills use loose, chilled steel shot. The Calyx drill is of this latter type. Diamond drills, used extensively in exploring ORE DEPOSITS and other MINERAL DEPOSITS, recover a core from 15/16 to 1 1/8 inches in diameter, whereas the shot drills cut holes from 2 3/4 to 20 inches in diameter.

In all rotary drills water is usually circulated down through the drill rods to the bit, and up to the surface in the space between the rods and the walls of the hole.

See also MINE EXPLORATION; PETROLEUM; PROSPECTING. B. L.

BIBLIOGRAPHY.—Robert Peele, *Mining Engineers' Handbook*, 1927.

DRILLING MACHINES or drill presses, in metal working, machine tools for drilling holes. They are built in many forms and sizes. Primarily, they hold the drill in a CHUCK, revolve it at its proper speed, and allow it to be fed into the work either by hand or power. Small drilling machines with hand feed are known as "sensitive" drills because of the sensitive control of the feed. An automatic feed is used on large drills and, in many cases, on the smaller ones, as it enables an operator to attend more than one machine.

Multi-spindle or multiple drills are largely used in large scale production operations, as in automobile manufacture. In some cases these machines have four or five heads, each carrying a large number of drill spindles and drilling simultaneously all the holes in one of the sides of a piece. Such drills have automatic feeds and also drive the different sized drills at their proper speed. All the operator does is put the work in place and remove it after drilling.

Radial drilling machines have been greatly developed and improved during the past few years. Not only are they made with greater capacity but they are stronger and much more convenient to operate than formerly. The latest machines have all the controls on the drill head so that an operator can stand by his work and control every movement of the machine. Drilling speeds have been increased, better bearings introduced, and revolving parts carefully balanced to avoid vibration and its attendant inaccuracy.

F. H. C.

DRILLS, in agriculture, devices for planting seed at close intervals in rows that are close together. Grain

drills may be simple seeders or combination sowing, fertilizing and tilling machines. Hoe, shoe, single-disk or double-disk furrow openers are used with or without trailing chains which drag soil over the seed. The larger drills are equipped with power lifts for raising the furrow openers. Two common feeding mechanisms are the fluted wheel and double-run feed wheel types. To reduce soil blowing and obtain more favorable conditions for germination in dry sections, press wheels may be used to compress the soil about the seed or the seed may be drilled in deep furrows or lists. See also PLANTERS. G. A. C.

BIBLIOGRAPHY.—H. P. Smith, *Farm Machinery and Equipment*.

DRIN, the largest river of Albania, formed by the junction of its two main tributaries, the Black Drin and the White Drin, both of which have their sources in western Macedonia. The Black Drin issues from Lake Ochrida and flows northward along the eastern edge of Albania till it meets the White Drin about 20 mi. southwest of Prizren. Here the Drin flows west and traverses northern Albania to empty into the Adriatic Sea near Alessio. The length of the Drin from the junction of its two tributaries to its mouth is about 110 mi.

DRINKER APPARATUS: For artificial respiration. See RESPIRATION, ARTIFICIAL.

DRINKWATER, JOHN (1882-), English poet and dramatist, was born at Leytonstone, Essex, June 1, 1882. He was educated at the Oxford High School, and worked for 12 years with an insurance company before going into theatrical work as manager and producer of the Birmingham Repertory Theatre which, under the name of the Pilgrim Players, he had helped to found. His first poems were published in 1908, and his first three-act play, *Rebellion*, produced in 1914, was followed by *Swords and Ploughshares*, *Oilton Pools and Tides*. In 1918, with *Abraham Lincoln*, he turned to the biographical plays on which his popularity chiefly rests. In 1921 *Mary Stuart* and *Oliver Cromwell* were produced, and in 1923 *Robert E. Lee*. In 1925 Drinkwater's plays were published in one volume, and his most noteworthy work in prose, a biography of Byron called *The Pilgrim of Eternity*, appeared.

DRIZZLE, a very slight RAIN, in which the drops of water are of very small size, not much larger than 1/20 part of an inch in diameter.

DROGHEDA, a seaport and municipal borough of County Louth, Irish Free State, lying on the Boyne River, some 4 mi. from its outflow in Drogheda Bay, and about 31 mi. northwest of Dublin. From the 12th century until the Reformation the seat of Irish primates of whose castle and summer palace there are remains, Drogheda suffered during the Civil and Cromwellian wars. There are fragments of an old Round Tower, the 13th century Magdalen Steeple and of several early monastic establishments. Upon the town's outskirts are ruins of the famed castle of Tara, once capital of Ireland, consisting largely of the banquet hall walls, some 750 ft. long. To-day,

Drogheda trade lies chiefly in the Boyne River salmon fisheries; there are textile mills and tanning and iron works. Pop. 1926, 62,739.

DROP FORGINGS, articles formed by striking metal between dies on a drop hammer. One die countersunk on the lower side with an impression of the article to be forged is fastened to the hammer and allowed to fall several feet against a die similarly countersunk on the upper side. A bar of hot metal struck between these dies is forced to fill the impression in the dies, metal in excess of what is used to fill the die flows out between the dies forming a fin called the "flash." This is sheared off while the forging is still hot. Complicated articles are formed in three stages, first bending the bar of metal to approximate shape, then forming in the rough die and finally in the finishing die all on one pair of die blocks. Large numbers of forgings are rapidly made by this process. Automobile crankshafts, connecting rods and front axles are typical drop forgings.

Dies must be properly made, having the right amount of taper or "clearance" on the sides so that the metal may be removed after being forged. Also, the operator must use considerable skill in shaping the steel before placing it in the dies. He may be required to reduce its diameter in some places and increase it in others by the use of "breaking down" dies before placing it in the finishing dies. In some machine forging, however, several sets of dies are provided so that the operator simply moves the hot steel bar from one die to the next, each die preparing the metal for the succeeding operation. The low cost of machine or die forging has made it possible to use high-grade drop-forged steel parts for many purposes for which hand forgings are too costly.

DROPSIE, MOSES AARON (1821-1905), eminent attorney and philanthropist, was born at Philadelphia in 1821. During his lifetime he was prominent in various social, charitable and educational endeavors. From 1867-73 he was president of the governing board of Maimonides College, and from 1893 on of Gratz College. For some time he was active in connection with various public works in his native city. He translated into English Mackeldey's *Handbook of Roman Law*, 1883, and in 1892 wrote *The Roman Law of Testaments, Codicils and Gifts in the Event of Death*. Dropsie died at Philadelphia in 1905.

In his will Dropsie provided for the founding of the Dropsie College for Hebrew and Cognate Learning in Philadelphia, which opened in 1907 and is devoted to study and research work in pure science and all branches of knowledge. The college, which confers the degree of Doctor of Philosophy and publishes the *Jewish Quarterly Review*, admits students irrespective of their religious beliefs, and has one of the finest Hebrew libraries in the United States, consisting of about 30,000 volumes. A. Sh.

BIBLIOGRAPHY.—*American Jewish Year Book*, 5683; H. S. Morais, *The Jews of Philadelphia*, 1894.

DROPSY. See ASCITES.

DROWNING: Artificial respiration in. *See* RESPIRATION, ARTIFICIAL.

DROYSEN, JOHANN GUSTAV (1808-84), German historian, was born at Treptow, Pomerania, July 6, 1808. He was graduated from the University of Berlin, and after teaching there for a time he became professor of history at Kiel in 1840. There he developed an intense interest in the Schleswig-Holstein controversy, publishing in 1850 a detailed history of the whole subject. A member of the Frankfort Parliament in 1848, he was named secretary of the constitutional committee. In 1851 he went to the University of Jena as professor of history and in 1859 to the University of Berlin. Droysen was one of the most eminent German historians. His most important work is the *Geschichte der Preussischen Politik*, 14 vols., Leipzig, 1855-86. He died in Berlin, June 19, 1884.

DRUG ADDICTION, repetition of the use of opium, cocaine and their derivatives, and also other narcotics, until it becomes a habit. Apparently the addiction is the result of weakness of the will of the individual who finds in the effect of the drug a release from his worries and pains, because the drug produces a condition called euphoria, a sense of well-being and happiness.

The withdrawal of the drug is associated with pain of an intense character, which the individual attempts to relieve by the taking of more narcotics. When a person has reached this stage in the use of the narcotic, he is said to have the habit, the colloquial term being that he is "hooked."

Dr. W. L. Treadway of the United States Public Health Service is convinced that the chief factor in drug addiction is ease of access to the drug. The causes of addiction are: first, previous use of drugs in medical treatment; second, self-treatment for relief of pain; third, recourse during emotional strain; fourth, influence of other addicts both in the community and in prison; fifth, for the sake of curiosity, thrill or bravado.

Addiction is more readily induced in some people than in others. In general, it is believed that the most important predisposing cause is an inherent mental or nervous instability. Addiction may be induced, however, by the injudicious use of drugs in people apparently free from any nervous or mental instability. Conversely such people may be freed of their addiction by proper treatment, without likelihood of relapse, whereas those with nervous instability are likely to relapse promptly when under stress.

Recent estimates indicate that there are approximately 100,000 drug addicts in the United States. The United States uses more narcotics for medicinal purposes than any other country, the figures being approximately 245 milligrams of morphine per capita as compared with 152 milligrams per capita for Europe, 8 for Asia, and 24½ for Africa. It has been suggested that Americans are more sensitive to pain than people of other countries, or else that American physicians are more inclined to prescribe narcotics.

Much of the drug addiction seems to be associated with the smuggling of drugs into the United States, which has extensive borders difficult to patrol.

The symptoms following withdrawal of drugs from addicts include usually abdominal pain, twitching, difficulty in breathing and in sleeping, and mental depression. The height of the withdrawal symptoms is between forty-eight and seventy-two hours following the last dose of the drug taken.

The treatment of addiction includes withdrawal of the drug, either suddenly or gradually; building of nutrition and general health, and psychotherapy. *See* also NARCOTICS. M. F.

DRUG ERUPTIONS. *See* ALLERGY.

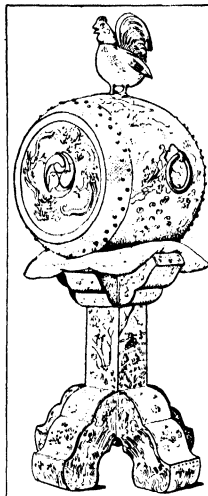
DRUG HYPERSENSITIVENESS. *See* ALLERGY.

DRUG-STORE BEETLE, a minute, reddish-brown insect (*Sitodrepa panica*) of the family *Anobidae*, which feeds on drugs, seeds, foods, condiments and books. Poisons, such as ergot, belladonna and aconite, do not seem to harm it. It can live and produce about six generations annually without water or air. Lutz records that in the American Museum of Natural History "numerous generations of off-spring" were reared 30 months on cayenne pepper in an hermetically sealed vial.

DRUIDS, the judicial and priestly class of pre-Roman Gaul, Britain and Ireland. From classical writers, who are the only sources and in such matters are far from dependable, it appears that Gallic druidism in its religious aspects was merely the classical pantheon translated into Celtic. The only essential difference noted is the druidic belief in the cyclical reincarnation of the soul. But that this resemblance to classical religion may in fact have been the case is suggested by the long-standing Greek colonies on the southern coast from which this religious view may well have spread into the barbarian north. Politically the druids were a noble class, maintaining through druidism a loose confederation of the Celtic tribes. By the times of the later Roman Empire druidism seems to have disappeared. Our knowledge of the druids in Britain and Ireland is drawn partly from Christian literature, where they are painted as magicians opposing the spread of Christianity. In pagan literature they correspond fairly with the descriptions given of the Gallic druids, though they did not constitute a corporation in Ireland. Further the literary functions of the Gallic druids appear in Ireland to be the provinces of special classes, the poets and bards. To the druids were long ascribed the great cromlechs and dolmens, such as Stonehenge. These works, however, are vastly more ancient than any knowledge we have of the druids, and there seems no reason to connect them.

DRUM, a musical percussion instrument used in the military band and the ORCHESTRA. From the earliest recorded times in all countries the drum has been popular, in one form or another, as a means of pointing the rhythm of the dance, marking the tread of advancing armies, or solemnizing the march of a funeral cortège. Without a definite pitch of its own,

in all its primitive and several of its modern varieties, it serves to heighten the melodic character of other instruments and to accent their metrical and rhythmic features. Although its chief concern is rhythm and meter, its relatively vague or totally absent pitch supplies a factor of large esthetic importance in the sum of its musical contribution, and this should not be, as it commonly is, discounted. In the present day three types of drum are used extensively:



COURTESY W. M. OF ART
JAPANESE TEMPLE DRUM

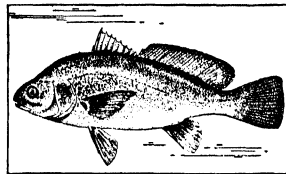
1. The bass drum, an instrument of large size, produces a tone of indefinite pitch that may be graded from a faint shudder to a gigantic *forte*. In the orchestra, especially in *forte* passages, it is usually sounded in conjunction with the cymbals; in quieter passages, when sounded alone, it is without a rival in inspiring the mood of desolation, and thus is often used in funeral marches.

2. The snare drum or side drum, known also as the military drum, is the smallest drum used in the orchestra. It is a small brass cylinder, the heads of which are covered with parchment. Snares, thin strips of catgut, are stretched across one of the heads and these, vibrating when the drummer beats upon the other head, produce that characteristic slithering sound which resembles a rending of silk to a tattoo accompaniment.

3. Kettle-drums, known in Italian as *timpani*, are so named because of their resemblance to large kettles. The drum proper, supported on short legs, is a deep copper basin across the head of which is stretched parchment or animal skin, usually calf, that can be tightened or loosened by means of turn-screws. By adjusting the latter, tones of more or less definite pitch can be generated when the performer beats upon the drum-head with two heavily padded drum-sticks. Two kettle-drums were the standard orchestral equipment of the 18th and 19th centuries, but three are common to-day, while for special effects some composers may call for a dozen. Of all forms of the drum, the kettle-drum is the most widely used for general orchestral work.

DRUM, the name of fresh and salt water fishes of the Croaker group (*Sciaenidae*), so-called because of the drumming noise they make, louder in the males than in the females. The sea-drum (*Pogonias cromis*) occurs on the Atlantic coast from Maine to Brazil. Its short, deep, dark gray body is usually about 4 ft. long, weighing from 40 to 50 lbs., although

larger specimens have been caught. In the South, it is in some favor as a food fish and is generally caught in nets or traps due to its habit of remaining near the bottom, moving sluggishly about. It feeds on shell fish, often discovered by means of the barbels on the lower jaw. Much damage is done to oyster beds by the sea-drums whose throats are equipped with strong teeth suitable for crushing. The fresh-water drum (*Aplodinotus grunniens*) inhabits lakes and sluggish streams from the Great Lakes through the Mississippi Valley. Popular names are sheephead,



FRESH-WATER DRUM

thunder-pumper and gaspergou. This fish resembles the sea-drum in appearance and habit, except for its silvery-gray coloring. Fishermen have some sport with them, though their flesh is coarse and not highly regarded. See ANGLING.

In 1929 the total commercial catch of drum in United States waters, chiefly red drum taken on the south Atlantic and Gulf coasts, amounted to 4,488,000 lbs. valued at \$276,000.

DRUMLIN, a smoothly arched, long, low hill distinctive of certain glaciated regions. The typical drumlin is oval, or shaped like an overturned canoe, about half a mile long, and from 100 to 200 ft. in height. Notable clusters of drumlins, all stretching in the direction of the ice movement, occur in Ireland and Scotland; near Madison, Wisconsin; between Rochester and Syracuse in New York State, and in eastern Massachusetts. The Battle of Bunker Hill was fought on a drumlin, one of a group on which Boston is built. These mounds of unstratified glacial till are believed to have been ridged upward beneath the ice-sheet.

DRUMMOND, HENRY (1786-1860), English statesman and writer, was born at Alresford, Dec. 5, 1786. After leaving Oxford, he was elected to Parliament where he was a member for many years. He allied himself with the movement to combat the spread of Socinianism and later became a leader of the Catholic Apostolic Church. His writings include *Abstract Principles on Revealed Religion*, *Discourses on the True Definition of the Church*, and *The Fate of Christendom*. He died at Albury, Surrey, Feb. 20, 1860.

DRUMMOND, SIR JAMES ERIC (1876-), first secretary-general of the League of Nations, born Aug. 17, 1876. Son of the Earl of Perth, he was educated at Eton, entered the British Foreign Office in 1900, and was later private secretary to Mr. Asquith, Sir Edward Grey and Mr. Balfour, accompanying the

latter on his mission to the United States in 1917. On the proposal of President Wilson, Sir Eric was appointed secretary-general of the League, which through his efforts has developed so that, by the addition of Mexico in Sept. 1931, there are 55 member nations. See LEAGUE OF NATIONS.

DRUMMOND, WILLIAM (1585-1649), Scottish poet, was born at Hawthornden, near Edinburgh, Dec. 13, 1585. He was educated at Edinburgh University and studied law at Bourges and Paris. Upon the death of his father, Drummond became Laird of Hawthornden. He returned there to spend the rest of his life pursuing a literary career. His works include *Tears on the Death of Meliades*, an elegy on the death of Henry, Prince of Wales, *Poems, Forth Feasting*, a collection of verse, *A Cypress Grove*, an essay, various political tracts and a history of Scotland from 1424 to 1542. Drummond died at Hawthornden, Dec. 4, 1649.

DRUMRIGHT, a city in Creek Co. in northeastern Oklahoma, situated near the Cimarron River, about 60 mi. northeast of Oklahoma City. The Santa Fé Railroad and a bus line serve the city. Gas and oil are the chief natural resources of the vicinity, and the city is an industrial center for the manufacture of oil products. Drumright was incorporated in 1913. Pop. 1920, 6,460; 1930, 4,972.

DRURY COLLEGE, at Springfield, Mo., a co-educational and non-sectarian institution, founded by the Congregational Church in 1873 as Springfield College. Later in that year it was reorganized under its present name. It had productive funds of \$1,085,578 in 1931. Harwood Library contains 48,466 volumes. In 1931-32 there were 310 students, and a faculty of 33 headed by Pres. Thomas William Nadal.

DRURY LANE THEATRE, a celebrated playhouse in Drury Lane, London, England. The original theater—known also as the Theatre Royal—was built by Thomas Killgrew in 1663 for the "King's Company of Actors." Destroyed by fire in 1672, it was replaced by a larger building designed by CHRISTOPHER WREN, and this was replaced by a yet larger structure in 1794, which burned down in 1809; the present theater, designed by Benjamin Wyatt, dates from 1812. With the checkered history of Drury Lane some of the greatest English actors, actresses and managers have been associated, as Garrick, Sheridan, Kemble, Peg Woffington, Mrs. Siddons and Macready.

DRUSES, a small Syrian sect numbering approximately 100,000, followers of a mystic religion founded in the 11th century by an Egyptian caliph named Al-hakim bi'amrillahi. The religion is a mixture of Christianity, Judaism and Mohammedanism and was carried to Syria by a missionary named Ismail Ad-darazi. The name "Druse" is derived from that of the missionary, and the language of the people is Arabic. The Druses are a warlike group and have frequently been at war with neighboring tribes.

During the World War, the Druses at first maintained an official neutrality, though they were subjects of the Turkish Sultan. Under the influence of the

English Colonel Lawrence, they joined the Allied forces against Turkey toward the end of the War. Although they expected to secure their full independence as a reward for this service, they were included in the Syrian mandate which was assigned to France by the Paris Peace Conference and the League of Nations.

In the summer of 1925, the discontented Druses from the Jebel district broke into open revolt against the French administration in Damascus. Two successful air attacks by French bombers, in 1925 and again in 1926, suppressed the revolt, if they did not allay the discontent.

BIBLIOGRAPHY.—"Druses," the *Dictionary of Islam*; E. P. MacCallum, *The Nationalist Crusade in Syria*, 1928.

DRUSUS, NERO CLAUDIUS (38-9 B.C.), Roman general, brother of TIBERIUS. Beginning his military career in 15 B.C., together with Tiberius he operated successfully against the Raeti and Vindelici, Germanic tribes which were making raids across the frontiers of Gaul. As governor in Gaul, 13 B.C., Drusus settled the grievances of the people by reassessing their taxes. But his fame as a soldier rests primarily on his campaigns of the following years carried on between the Rhine and the Elbe. Earning by his victories the title of "Germanicus," he was the first Roman general to lead an army to the shores of the German Ocean. By his wife Antonia, daughter of Mark Antony, he was the father of CLAUDIUS, the future (41-54 A.D.) emperor.

DRYADES or **DRYADS**, in Greek mythology, nymphs of the woods who dwell in the trees, especially in oaks. The life of each Dryad was inseparable from her tree and for this reason they were also called Hamadryads, meaning the spirit of the tree. The Dryad came to life with her tree, protected it and died with it. Dryades was later a name given to wood nymphs in general.

DRYADS. See DRYADES.

DRYASDUST, REV. DR., a fictitious personage who was passed off for many years by SIR WALTER SCOTT as the author of the *Waverley Novels*. The name is often applied to authors whose pedantry and dullness of style make them deserve such a distinction.

DRYBURGH ABBEY, formerly a Premonstratensian monastery, now a picturesque ruin, 3½ mi. southeast of Melrose, Roxburghshire, Scotland. The remains of the abbey, which was founded in 1150 by Hugh de Morville, include parts of the cloisters, refectory, church, chapter house and other domestic buildings dating from the 12th to 15th centuries. The graves of Sir Walter Scott, whose estate, ABBOTSFORD, is 6 mi. to the east, his wife, his son, and his biographer, J. G. Lockhart, are at Dryburgh Abbey, which was presented to the nation in 1913 by Lord Glenconner.

DRY-CLEANING, the art of cleansing clothing and other textile fabrics by washing or brushing them in a liquid or solvent which contains no trace of moisture. It originated in France about the beginning of the 19th century, but developed to its highest

standards in Germany, England, and the United States. The liquid first used was camphene, a distillate of turpentine; later benzene, benzol, gasoline, naphtha, Stoddard solvent (a petroleum distillate of low flammability), carbon tetrachloride, and trichloroethylene were employed for the purpose. Its greatest impetus was received in the period when gasoline was a cheap by-product of the kerosene industry.

In many respects similar to the power laundering industry, except that great skill and considerable knowledge of chemistry are required to recover the many hundreds of gallons of dry solvent used in the washing and rinsing processes and which, because of their cost (ranging in 1931 from 15 cents to \$1.25 per gallon) must be used again, after being reconditioned and freed from all soil, fats, oils and greases. The other difficult phase of the process is the removal of special spots and stains of a chemical or other nature from fabric, which requires a knowledge of the textile fiber, the original dyestuff employed and the mild solvents which can be employed in their removal. This is a tedious hand process known as spotting.

In general the difference between dry-cleaning and laundering, aside from the fluid employed, is that in all plants, including the largest, each garment is handled in the spotting and finishing (pressing) processes as an individual unit, and each requires distinctive treatment.

The first dry-cleaning plant in America was Barrett, Nephews & Co., established on Staten Island in 1817. The number of plants had grown to approximately 50 by 1890; to 200 in 1900; to 2,000 in 1916, and to 7,500 in 1930. The total volume of business handled in the industry was approximately \$50,000,000 in 1916, and \$500,000,000 in 1930. Technical resident instruction and educational extension work is provided by a single organization covering the entire industry, known as the National Association of Dyers and Cleaners with headquarters, offices, training school, laboratories, and model plant at Silver Spring, Maryland, a suburb of Washington, D.C. P. C. T.

DRYDEN, JOHN (1631-1700), English poet, was born at Aldwinkle, Northamptonshire, Aug. 9, 1631. He graduated at Cambridge in 1654 and went to London in 1658. In 1659 he wrote *Heroic Stanzas in Memory of Oliver Cromwell*, but on the Restoration executed a volteface in *Astraea Redux* and a *Panegyric*, 1661. After several poor comedies he produced the spectacular *Indian Queen*, 1664, with Sir Robert Howard, and followed it with *The Indian Emperor*, 1665. Other comedies were *Sir Martin Mar-all*, 1668; *An Evening's Love*; *Ladies à la Mode*, 1672, and the prohibited *Limberham*. He was more successful in tragedy. *Tyrannic Love*, with considerable collaboration from the stage carpenter, appeared in 1669; *The Conquest of Granada*, 1670; *All for Love*, 1678, a version of Shakespeare's *Caesar and Cleopatra*, and *Don Sebastian*, the last two probably his best. His comedies are coarse, even for the age, and in tragedy he bowed, facile as ever, to the vulgar taste for extravagance. In 1661 he satirized the Duke of Shaftesbury in the

famous poem *ABSALOM AND ACHITOPHEL*. On James's accession Dryden became a Roman Catholic, the sincerity of which conversion has been questioned and defended. At least, at the Revolution, Dryden's professed faith cost him his Laureateship and his pension as royal historiographer, but he still reigned as literary dictator in Wills's Coffee Shop. He turned to the stage again, and in 1697 published his translation of Vergil. His *Fables* appeared in 1697. Dryden's lyrics have a stately beauty, but his plays were inferior works, without truth or humanity. His prose shows a mind trained to the order and even measure of the classics and he is an important figure in the development of literary criticism. His satires were, given the taste for powerful invective, masterpieces of their kind. Dryden died in London May 1, 1700, and was buried May 13 in Westminster Abbey.

BIBLIOGRAPHY.—Dr. Samuel Johnson, *Life of Dryden*, new ed., 1913, G. Saintsbury, *Life of Dryden*, 1881; Mark Van Doren, *The Poetry of John Dryden*, 1920.

DRY DOCK, in a broad sense a facility for taking a vessel out of the water—usually for the purpose of repairs. There are several types: 1. *Graving Dry Dock*, or *Graving Dock*, a fixed basin, into which the vessel is floated, a gate closed and the water removed, allowing the vessel to settle on prepared blocking; 2. *Floating Dry Dock*, a floating structure or cradle, which is raised, after the vessel is floated into it, by pumping air into its water compartments, thereby raising the ship out of water; 3. *Lift Dock*, one into the cradle of which a ship is floated and lifted by hydraulic or other power; 4. *Marine Railway*, a cradle structure operating on an inclined track or "railway" extending both below and above water. The vessel is floated into the cradle in its submerged position and then the cradle is drawn out of the water up the track.

Graving docks are commonly constructed of timber

NOTABLE DRY DOCKS FLOATING DOCKS

Location	Name	Effective Dimensions			
		Length Ft.	Width Ft.	Depth Ft.	Lifting Capacity Tons
Amsterdam, Netherlands	Juliana No. 5	650	100	26	25,000
Bordeaux, France	Port Automobile	721	111	26	25,000
* Hamburg, Germany	* Blohm-Voss, 6	575 550	123	33	46,000
Malta	Valletta	962	140	38	65,000
Montreal	Connaught	600	100		25,000
Nicolaieff, U. S. S. R.		558	136	30	30,000
Rotterdam, Netherlands	Wilton No. 4	695	142		46,000
Singapore, Str. Set.	Naval Base	858	132		
Southampton, England		849	126	40	50,000
		960			
		860	130	35	60,000

* Two other docks over 25,000 tons capacity.
(Figures from Lloyds Register of Shipping 1930-31.)

GRAVING DOCKS

Location	Name	Effective Dimensions		
		Length Top Bottom Ft.	Width, En- trance Ft.	Depth Over Sill at High Water Ft.
Belfast, Ireland	Thompson	864 850	96	35
Bombay, India	Hughes	1000 998	100	35
Boston, Mass.	Navy (Commonwealth)	1200 1171	120	46
Bremerhaven, Germany	Kaiser	879	132	38
Cherbourg, France	Homot	820	118	36
Durban, S. Africa	S. A. Railways and Harbors	1166 1150	110	41
Gibraltar	Admiralty	863 851	95	39
Glasgow, Scotland	Clyde No. 3	880	83	27
Hongkong, China	Taikoo	787 750	88	35
Le Havre, France	Maree	1049 956	113	26
Liverpool, England	Canada	926	94	31
New York, New York	Todd No. 1	731	89	32
Norfolk, Virginia	Navy No. 4	1011 1001	116	44
Balboa, Panama, Canal Zone	Balboa	1110 1000	110	48
Pearl Harbor, Hawaii	Navy No. 1	1008 997	114	35
Philadelphia, Pa.	Navy No. 3	1022 1005	127	44
Puget Sound (Bremerton), Washington	Navy No. 2	809 756	121	38
Puget Sound (Bremerton), Washington	Navy No. 3*	950 929	130	23*
Quebec, Canada	Champlain	1150	120	40
St. John, N. B., Canada	St. John	1225 1150	133 125	42
San Francisco, Cal.	Hunters Point No. 2	1020 1000	153	40
Southampton, Eng.	Trafalgar	912 852	100	35
Singapore, Str. Set.	Kings	879 873	100 93	34
Taranto, Italy	Ferrati	820 807	133 115	39
Venice, Italy	Piemonte	820 810	117	36
Victoria, B. C., Canada	Esquimault	1150	125	40

* Shipbuilding Dry Dock.

or masonry, with timber or steel gates. In America gates are commonly of the "caisson" type, being floated into and out of the dry dock entrance. Hinged mitering gates, as used for Locks, are quite commonly employed in dry docks in Europe but rarely in America—the one exception being the large dry dock at the Balboa terminal of the Panama Canal.

In ancient times, dry docking entailed beaching a vessel and hauling it out on land, advantage being

taken of tidal and seasonal variations in water level and of inclined shores and natural basins.

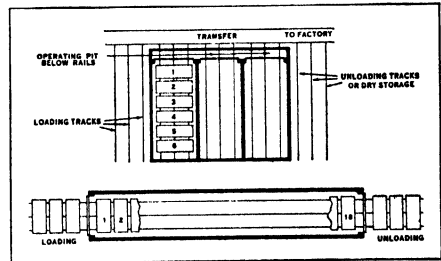
F. R. H.

BIBLIOGRAPHY.—M. Merriman, *American Civil Engineers Handbook*, 1930.

DRY ICE. See CARBON DIOXIDE SNOW.

DRYERS, WOOD PRODUCT. Freshly sawed lumber contains at least 50% moisture, requiring 60 days to six months to dry for shipping. Lumber kilns will shorten this time down to four to ten days.

Mechanical lumber dryers are designed to speed up drying at the mill and to carry the factory processes to the content (5%) required for cabinet work. Lumber kilns are usually of the steam-heated type with a liberal use of the spray to prevent any case



LUMBER KILNS

Single charge kiln (above); progressive kiln (below)

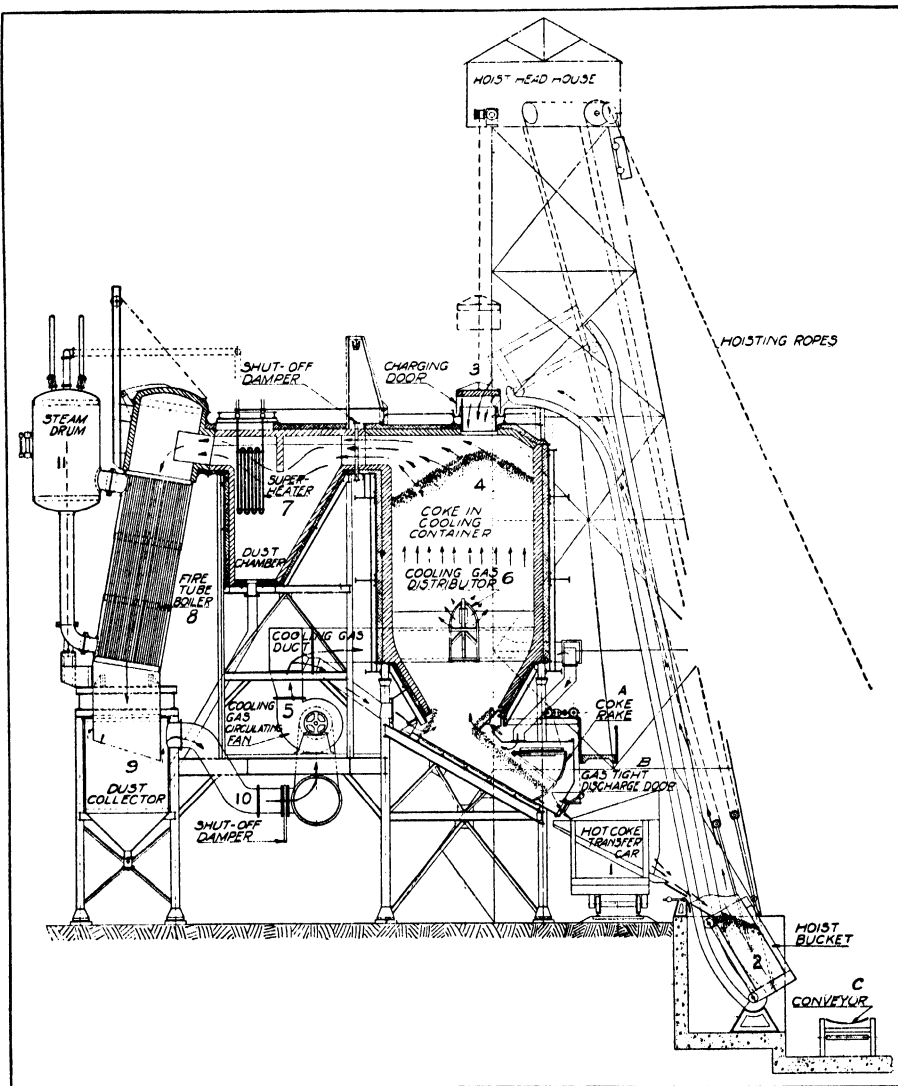
hardening of the board surface. Such kilns may be of the progressive type or of the single charge type. Circulation of the drying may be accomplished by mechanical blowers or fans, by stimulated natural draft, or by condensing coils and recirculated air.

Veneer dryers are of the roller, platen, or mesh type. Veneer drying can usually be accomplished in 10 to 60 minutes. Platen dryers are usually used for final drying to 5% and for flattening the veneer before gluing into plywood.

DRYING AND DRYING EQUIPMENT. The removal of a comparatively small amount of liquid from solid or nearly solid material is called drying. In the usual case, the liquid removed is water. Also ordinarily, the water is removed by vaporizing it at a temperature below the boiling point, and sweeping it away in a stream of air or other gas. It is necessary that heat be supplied in the process.

Many types of drying equipment are available. The dryer best suited for a particular problem depends upon such factors as: the scale of operation; the permissible temperature that can be used without impairing the quality of the product; the form of the material, whether sheets, grains, paste, sludge, or liquid; the possible necessity of protecting the material from direct contact with furnace gases; the permissible rate of drying, etc.

One type of dryer, suitable for handling materials in sheet form (paper, leather, etc.) or on trays (dyes, pigments, cakes) consists of a closed compartment through which hot air is passed.



COURTESY INTERNATIONAL COMBUSTION ENGINEERING CORP.

DRY QUENCHING INSTALLATION

Hot coke is deposited in the cooling container (4). Cooling gases are circulated by the fan (5) through the gas distributor (6). After extracting heat from the coke, the gas releases this heat to the superheater (7) and boiler tubes (8), returning to the fan through the dust collector (9) and the shut-off damper (10).

For granular or loose materials rotary dryers are often used. The wet material enters the higher end of a hollow, nearly horizontal, rotating cylinder. The rotation of the cylinder causes the material to move gradually to the lower, or discharge end. Hot air or

furnace gases pass either through the dryer, in parallel or COUNTER-CURRENT Flow or around the outside of the dryer shell. In the latter case, air is blown through the dryer to remove the water vapor. Many other types of dryer are also available.

W. L. McC.

DRYNESS, CHEMICAL, the absence of moisture in chemical substances. As early as 1780 it was noted that the rates of certain chemical reactions were markedly lowered by intensive drying of the reactants. Since then many similar instances have been reported, and numerous reactions appear to be totally inhibited by intensive drying. The theory that no chemical reaction can take place at all in the total absence of moisture has been seriously advanced, but is now thoroughly discredited. It has also been noted that the physical properties of many substances are appreciably altered by intensive drying. There is as yet no adequate general explanation of these phenomena.

Chemical dryness may be produced by chemical or physical means or by a combination of the two. The physical method usually consists in heating the portion of the system to be dried and trapping the water VAPOR liberated by means of a cooled absorbent, such as charcoal or SILICA GEL, or by freezing it with some such refrigerant as LIQUID AIR. The chemical method employs substances which have a strong affinity for water, e.g., phosphorus pentoxide and concentrated SULPHURIC ACID. O. R.

BIBLIOGRAPHY.—J. W. Smith, *The Effects of Moisture on Chemical and Physical Changes*, 1929

DRY-POINT, a manner of drawing, for reproduction, with a sharp point directly upon a bare copper-plate. In the nervous quality of the lines, though these are never acid bitten, dry-point is essentially an etcher's, not an engraver's art. Its character depends upon the "burr," a ridge of copper thrown up as the needle scores the plate. In printing this holds much ink, producing rich, velvety blacks akin to MEZZO-TINT. Early impressions are more valuable, as the burr wears down in the press. To prevent this the plates are often steel-faced. Dry-point is much used in retouching etched plates.

DRY QUENCHING, the process of cooling COKE without the use of water. It has been brought about by the necessity of eliminating the operation difficulties and destructive dust-laden vapor clouds common to wet-quenching installations and by the desire to make use of the sensible heat in the coke. The cooling is accomplished by the continuous circulation of an inert gas in a closed cycle, first through the hot mass of coke where it extracts the sensible heat, thence through a steam BOILER where it transfers the heat to the water, converting it into steam. The gas then returns through a fan to the distributor from which it again passes through the mass of coke. The coke being quenched is held in a container which is intermittently charged through the top and emptied through the bottom. Coke quenched in this manner is cleaner, devoid of moisture and contains more heat units as received by the consumer than does wet quenched coke.

Dry quenching of coke is as great an improvement over wet quenching as the modern by-product coke plant is over its predecessor, the beehive oven plant.

The figure outlines the operation of a dry quenching installation. W. O. R.; K. T.

DUALISM, a philosophical position recognizing two opposing principles. Although it may take many forms it is most closely associated in the western world with the metaphysical position which recognizes two fundamental substances, viz., mind and matter. These were the two realities recognized by RENÉ DESCARTES, and much of modern philosophy has been an effort to escape from this fundamental dualism.

Dualism was given a cosmic significance in Zoroastrianism, which conceived of the universe as a battleground for the two contending forces of good and evil. (See ZOROASTER.) Dualism also occupied a prominent place in Plato's thought of his world of Ideas and his world of perception, his world of being and that of not-being. Kantian philosophy was essentially dualistic. (See PLATO; KANT, IMMANUEL.) From the standpoint of knowledge, dualism makes the distinction between sense and understanding; metaphysically, between the world of phenomena and the world of noumena; ethically, between reason and desire, an ever-present conflict.

DUALITY, a principle of mathematics, used chiefly in PROJECTIVE GEOMETRY. It asserts that corresponding to any figure consisting of *points*, *lines* and *planes* there exists another figure consisting of *planes*, *lines* and *points* such that, respectively,

to every	<i>point</i>	<i>line</i>	<i>plane</i>
there corresponds a	<i>plane</i>	<i>line</i>	<i>point</i> .

It further asserts that to every proposition relating to the former figure (not essentially involving measurement) there corresponds a similar proposition relating to the latter one, and that the two propositions are either both true or both false. For example, the following are dual propositions:

Two <i>points</i> determine a <i>line</i>	Two <i>planes</i> determine a <i>line</i>
Two <i>lines</i> through a <i>point</i> determine a <i>plane</i>	Two <i>lines</i> in a <i>plane</i> determine a <i>point</i> .

DUANE, WILLIAM JOHN (1780-1865), American public official, was born in Tipperary, Ireland, May 9, 1780. In Clonmel he attended a grammar school for about 15 months, this brief period covering his total formal education. He attended sessions of Parliament with his father and heard the great debates of the day. In 1796 the family came to America, where the father and son found work on the Philadelphia *True American*. William married the granddaughter of Benjamin Franklin in 1808. In 1809 he was elected to the state legislature by the Democratic party, and re-elected in 1812 and 1813. In 1815 after his admission to the bar he was noted for his ability to compromise disputes and avoid litigation. He was sent to Congress in 1819. In 1833 he became Secretary of the Treasury under Jackson, but was dismissed after four months for his refusal to transfer Government deposits from the United States Bank to state banks without the authority of Congress. After 1833 he resumed

law practice at Philadelphia, and served as a director of Girard College. He died at Philadelphia, Sept. 26, 1865.

DU BARRY, MARIE JEANNE BÉCU, COMTESSE (1743-93), French courtesan, was born at Vaucouleurs, Aug. 19, 1743, the illegitimate daughter of a poor woman. After a brief schooling she worked in Paris as a milliner and later became a well-known courtesan. Brought to the notice of Louis XV, he was immediately attracted by her beauty and wit and she became his mistress. For her formal presentation at court a title had to be found for her, and this was effected by marrying her to Count Guillaume du Barry, the brother of the dissolute nobleman who introduced her to the king. Her political influence was almost unlimited but she was unpopular with both the court and the people, and on the death of Louis XV she was forced into the background. When the French Revolution was at its height in 1792, she was arrested and condemned to death for wanton extravagance with state funds and as a conspirator against the Republic. She was guillotined in Paris, Dec. 7, 1793.

DU BARTAS, GUILLAUME DE SALLUSTE.
See BARTAS.

DU BELLAY, JOACHIM (c. 1524-60), French poet, was born near Angers, about 1524. He was one of the six poets under Jean Daurat who formed the so-called Pléiade. Du Bellay has been called "the French Ovid." He wrote *Recueil de Poésies, Regrets* and the *Defense and Illustrations of the French Language*, a prose work. EDMUND SPENSER translated many of his sonnets into English. Du Bellay died in Paris, Jan. 1, 1560.

DUBLIN, the capital of the IRISH FREE STATE, situated on Dublin Bay, in 53° 20' 38" N. lat. and 6° 17' 30" W. long., about midway on the east coast of Ireland. The city is built on both sides of the River Liffey, which intersects it east and west. This tidal river is lined on each side by fine stone quays, is dredged so as to admit vessels of 23 ft. draft at high tide and is spanned by 10 bridges for passenger and general traffic. Two canals connect the Liffey harbor with the River Shannon.

Dublin is remarkable for the beauty of its surroundings, particularly on the south where the mountains of the Wicklow Range advance to the suburbs. The city is for the most part well built, with wide streets and an unusually large number of open squares and public gardens. Phoenix Park, on the outskirts of the city, includes a public garden, zoological gardens, a race track and a large parade ground. The botanical gardens and cemetery at Glasnevin are also famous. The public buildings date from the prosperous days of the 18th century, when architectural schemes on a vast scale were carried out at government expense. The Parliament buildings, facing Trinity College, are occupied by the Bank of Ireland, but the House of Lords has been preserved in its original state. Trinity College was founded in 1592, and its grounds occupy an area of 28 acres. The classic buildings are constructed of massive granite and lime-

stone. The National University, founded in 1908, occupies the buildings of the superseded Royal University, founded in 1880, which was only an examining body. There are two ancient cathedrals, the learned Royal Dublin Society, incorporated in 1750, and Dublin Castle. The castle, without striking architectural features, was until 1922 the official center of the government of Ireland.

Although there are few industries of any special note, the city has the largest brewery in the world, several distilleries for the preparation of the famous pot-still whisky and factories for the manufacture of poplin, mineral waters, biscuits, cigarettes and paper.

The population in 1926 was 316,693. In 1930 Greater Dublin was created by Parliament, and this absorbed the suburbs Rathmines and Pembroke and other parts of Dublin County, making a total population of about 450,000.

DUBLIN, a city and the county seat of Laurens Co., situated near the center of Georgia on the Oconee River. Bus lines and three railroads serve the city. Cotton, corn and truck garden products are the principal crops of the region. The city is a distributing center for agricultural products and lumber. The chief industries are cotton, cottonseed, lumber products and fertilizer manufactures. Pop. 1920, 7,707; 1930, 6,681.

DUBLIN, UNIVERSITY OF, another name for Trinity College, a noted institution occupying a large site in the middle of Dublin, Ireland. It was founded in 1592, receiving its charter from Queen Elizabeth as the College of the Holy and Undivided Trinity. Its first chancellor was William Cecil, Lord Burghley. Early in the 17th century the institution received from James I an annual pension and estates. The University of Dublin is unique in having but a single college, endowed with the functions of both a college and a university. The university now comprises a Faculty of Arts and the professional schools of Divinity, Law, Physics, Engineering, Agriculture, Forestry, Music, Indian and Home Civil Service, Education and Commerce. In 1929-30 the total enrollment was 1,868. In 1904 women were first admitted to degrees. The university is well equipped with laboratories, hospitals, museums, a herbarium, botanical garden, and a library containing 390,000 volumes and many early Irish manuscripts. The Astronomical Observatory is at Dunsink, five miles away. The chancellor of the university in 1930 was the Rt. Hon. Earl of Iveagh; the vice-chancellor, the Rt. Hon. Baron Glenavy.

DU BOIS, a city in Clearfield Co., western Pennsylvania. It is situated on Sandy Lick Creek, 85 mi. northeast of Pittsburgh; it is served by three railroads. Du Bois is beautifully situated in the Allegheny Mountains. It is a trade center in a coal-mining and timber-cutting region, and a thriving industrial community with machinery plants and car shops, foundries, flour, lumber and silk mills, and wood-working establishments. In 1929 the industrial output was valued at approximately \$3,000,000. In 1929 the

retail business reached a total of \$6,377,635. Dairying and farming are the leading interests of the countryside. Du Bois was settled in 1872 and incorporated in 1881. Much of the forest land east of the city is under state control. Pop. 1920, 13,681; 1930, 11,595.

DUBROVNIK. See RAGUSA.

DUBUQUE, a city in northeastern Iowa, the county seat of Dubuque Co., situated on the Mississippi River, 176 mi. northwest of Chicago. Four railroads and numerous river craft afford transportation. The Mississippi River steamers in winter have dry-docks at Dubuque. The city has a large industrial output, including sashes, doors and blinds, leather and iron products. There are also meat packing houses and grain elevators. In 1929 the total manufactures were approximately \$22,000,000; the retail trade was valued at \$24,527,852. The region produces lead and zinc, and is fine farming country. Located here are Columbia College for men and Mount Saint Joseph College for Women, two Catholic institutions, and the University of Dubuque. There is a Trappist monastery 12 mi. away. Dubuque is the oldest city in Iowa. Julien Dubuque settled here in 1788, exploiting the lead in the vicinity. Later the encroachment of lead miners on the rights of the Indians was repulsed by Federal troops under Zachary Taylor. Dubuque was incorporated in 1837. Pop. 1920, 39,141; 1930, 41,679.

DUCANGE, CHARLES DU FRESNE (1610-1688), one of the great French scholars who, with others, laid the foundations of scientific historical criticism. A failure as a lawyer, he spent the last 20 years of his life in Paris, studying medieval manuscript materials in the archives. His marvelous understanding of languages, combined with accurate, varied knowledge, critical skill, and diligence, bore fruit in the publication of several masterpieces of philological research. He published the *Glossarium ad scriptores mediæ et infimæ latinitatis* in 1678, and the *Glossarium ad scriptores mediæ et infimæ græcitatís* in 1688. His greatest work, however, was the first mentioned glossary, an historical dictionary of medieval Latin, in which the article devoted to each word consists of a collection of passages in which it occurs, chronologically arranged, with notes on the author and changes in meaning. This work is still the indispensable medieval Latin dictionary. He also published many editions of the works of Byzantine historians, and is known as the founder of Byzantine studies.

DUCAT, the name given to different coins, usually gold, which were widely used in Europe. Their value varied in different countries, but was usually about \$2.30. The first ducat was coined in Sicily in the 12th century.

DUCK, the common name for an important group of web-footed, aquatic birds, many of which are extensively hunted as game and also highly esteemed for food. The true ducks, together with the mergansers, geese and swans, comprise the numerous family *Anatidae*. The true ducks are distinguished from the narrow-billed mergansers by having a broad flat

bill; they differ from the geese and swans in having much shorter necks and by the fact that the male and female are usually more or less unlike in color. The true ducks are noted for their unusually strong swift flight and certain species for their remarkable powers of diving and swimming beneath the surface of the water. Though some subsist largely on aquatic plants, most ducks live chiefly on animal food, especially insects, mollusks, crustaceans and small fish.

The ducks are divided into five distinct divisions or subfamilies, the largest of which are the bay or sea diving ducks (*Nyrocinæ*) and the river, pond or dabbling ducks (*Anatinæ*), the former having a lobe or web on the hind toe and the latter lacking it. The diving ducks number upwards of 50 species, frequenting the open waters of the seas, bays, lakes and rivers. They secure their food by diving, feeding by day and resting at night. Among the sea ducks are the well-known canvasback, redhead, scaup and eider.

The dabbling ducks, which embrace about 70 species, inhabit slow streams, lakes, ponds and sometimes the shores of seas. They secure their food by probing the bottom of shallow waters, feeding often at night. Among the best known dabbling ducks are the mallard, which is the parent of the domestic duck, and also the black duck, the widgeon, pintail, wood duck, shoveler, teal and baldpate. The other subfamilies of ducks are the true duck (*Dendrocyguinæ*), the mergansers (*Merginæ*) and the ruddy ducks (*Erimaturinæ*).

Most ducks go northward to breed, nesting in the interior of North America from Nebraska to the Great Slave Lake, and migrating for the winter to California, the Gulf and South Atlantic states, so that in most parts of the United States they are seen only as birds of passage. See also GOOSE; MERGANSER; SWAN; POULTRY; articles on the ducks mentioned.

DUCKBILL, an Australian monotreme animal (*Ornithorhynchus anatinus*) resembling a small otter in form, fur, and webbed toes called platypus. It is aquatic, and its lips are stiffened into the shape of a duck's bill, and serve, duck fashion, in taking as food small animals, larvæ, and so forth, from the bottom



DUCKBILL

of pools. It spends the day in a burrow in the riverbank, where annually the female produces one or more eggs, from which soon hatch immature babies; these the mother, who has no teats, places within a fold of her abdomen, where they attach their mouths to the naked skin and obtain milk. The duckbill is now legally protected from threatened extermination. See ECHIDNA.

E. I.

DUCKING STOOL, a crude mechanical device formerly used in punishing women convicted as witches, scolds, or prostitutes. Invented probably early in the 17th century, used extensively in England and in parts of America, the ducking stool consisted of a crude chair attached to the end of a moderately long beam which worked see-saw fashion on a pivot. The apparatus was ordinarily set up at the edge of a pond or river.

DUCK SHOOTING, a sport popular in almost every country in the world. It may be divided into shore shooting and shooting from a float. In shore shooting, the sportsman chooses a point on the water-front or at the edge of marshes over which the waterfowl pass at sundown or daybreak, or on their way to or from their feeding grounds. He may crouch behind driftwood or a small sand dune, or in a blind dug out in the sand and lined on the water side with reeds, grass or any other material to camouflage his position. Decoys, live or artificial, may be used. Waterfowl, being fond of wild rice and celery, often come to waters where they are planted.

When shooting from a float, conditions are much the same except that the sportsman uses a punt or a duck boat. These craft draw little water, so they may be poled or pulled through shallow marshes. In the United States, duck boats are often decked over, the deck being almost level with the water. The hunter sits in a kind of cockpit with only his head and shoulders visible. In the United States, the favorite duck hunting gun is the 10-gauge.

Waterfowl of the United States include geese; swans; canvasback, black, redhead, and mallard ducks; teal, and snipe.

See Abel Chapman, *The Art of Wildfowling*.

DUCKWEED, a genus (*Lemna*) of minute floating aquatic plants comprising about 6 species found in stagnant waters widely throughout the world. They are among the smallest and simplest of flowering plants, consisting in most species of a flat green floating stem which performs the function of leaves. From the lower surface hangs a single slender root. The very small flowers are borne on the edge or upper surface of the plant.

DUCOMMUN, ELIE (1833-1906), Swiss publicist, was born at Geneva, Feb. 19, 1833. He became editor of the influential *Revue de Genève* in 1855, and was the author of a number of progressive and liberal articles published in other journals. He was chancellor of the Canton of Geneva and secretary of the Jura-Simplon Railroad, but he later devoted all his efforts to the furtherance of world peace through international law. He organized the International Peace Bureau at Berne. For this and other work for world peace, he was awarded, with Albert Gobat, his fellow-countryman and colleague, the Nobel peace prize in 1902. He died at Berne, Dec. 7, 1906.

DUCTILITY TEST. See ASPHALT TESTING.

DUCTLESS GLANDS. See ENDOCRINE GLANDS.

DUDEVANT, AMANDINE LUCILE AURORE. See SAND, GEORGE.

DUDLEY, a county borough of Worcestershire, England, 121 mi. northwest of London. Located in the center of a coal district, it owes its origin to the castle of which Camden wrote, "it towereth up upon a hill, built and named so of one Dudo or Dodo, an English Saxon, about the yeere of our salvation 700." A disastrous fire in 1750 reduced it to ruins of which the keep, turreted tower and gateway still stand in the midst of a 70-acre wooded parkland. Close by are the fine remains of a 12th century Cluniac priory. Geologically Dudley is interesting in its rich Silurian deposits in the limestone. Situated in a coal-bearing region, mining was important as early as Edward I, and since the early part of the 17th century has been of primary importance. There also are engineering, brick and glass works, brass and iron foundries and freestone and dolerite quarries. Pop. 1921, 56,098; 1931, 59,579.

DUELING, a prearranged combat between two armed persons in the presence of witnesses. The challenged man has the option of choosing the weapon to be used, which in earlier times was almost universally the rapier and in the 18th century generally the pistol. Friends of the antagonists, usually two for each, act as seconds for setting the place and conditions of the duel and are later present as witnesses. In a few duels in the 17th century the seconds also fought sometimes between themselves.

The duel is a strictly western European institution, and so brought to America, being unknown in antiquity and in the Far Eastern civilizations. Its origin is sometimes thought to lie in the wager of battle fought before a court to determine an issue of judicial fact. But while the wager of battle was based upon the belief that God would not allow the innocent to be vanquished, the duel depended upon the assumption that a man's life was of less worth than his honor. The judicial combat was open to all freemen; but the duel was confined to the aristocracy, and the combat had almost disappeared before the duel became common. It is more probable that the duel sprang up of itself as a self-evident institution in the aristocratic society of the late 15th century. In early times duels were fought over vital points of honor but increasingly trifling disagreements gave grounds for engagements.

Early in the 17th century dueling became so common in France that the Royal Government attempted to check this wholesale self-slaughter of the nobility. Courts of honor were established to see that duels were not fought over trifles; permission was required from these courts before a duel could be legally held. Illegal dueling was later made a capital crime, and in 1627 Richelieu executed the Count de Boutteville who had provoked a duel and killed his opponent for mere sport. The law was never strictly enforced; but dueling became less common under Louis XIV. After the Revolution and Napoleon dueling almost disappeared in France except for the generally innocuous so-called duels which are still staged occasionally.

Dueling did not become common in England until the reign of James I. It was still usual under George

III, but died out completely in the early years of Victoria. In 1844 stringent army rules were made against it. The duel with rapiers was never common in America, and in fact dueling was never so common as in Europe. The death of Alexander Hamilton in a duel with Burr outraged public opinion; but duels did not altogether cease until the Civil War, many prominent men being involved in one or another, including President Jackson, Gov. De Witt Clinton, Henry Clay and John Randolph.

Dueling with the permission of army courts of honor was still permitted in the German Empire; but the Republic has announced that it will not tolerate them. The so-called duels of the German student corps are actually a type of fencing in which it is possible to inflict small cuts upon the cheeks of an opponent; they lack both the vital elements of a duel, the cause and the possibility of the death of either combatant.

DUGGAN, STEPHEN PIERCE (1870-), American educator, was born in New York, Dec. 20, 1870. He was graduated from the College of the City of New York in 1890 and took his Master of Science degree there in 1896; he received his M.A. at Columbia in 1898 and his Ph.D. in 1902. Duggan joined the faculty of the College of the City of New York in 1896, and has served as instructor, associate professor and professor of political science. In 1919 he became director of the Institute of International Education. From 1922-23 he was president of the New York Academy of Public Education, and from 1924-25 lecturer on international relations at Columbia University. He became secretary of the American University Union in Europe in 1926, and has taken a prominent part in foreign relations and world affairs. Duggan is author of *The Eastern Question—A Study in Diplomacy*, *A History of Education*, and *The League of Nations*.

DUGONG, an aquatic mammal. See **MANATEE**.

DUGOUT. See **BOAT**.

DU GUESCLIN, BERTRAND (c. 1320-80), Constable of France and general, was born in Brittany, about 1320. At an early age he became famous in jousts and tournaments, and was active in fighting the English armies in France. He was very successful but was finally defeated by the Black Prince of England. He was later released, and was made Constable of France by the king. He again started fighting the English, and succeeded in driving them out of many provinces in northern France. He died July 13, 1380.

DUHAMEL, GEORGES (1884-), French poet and novelist, was born in Paris, June 30, 1884. He was educated for the medical profession. He began his literary career with a volume of poetry, published in 1907, and during the next few years three plays by him were produced in Paris. In 1914 he served with the French Army in the World War; two books, *La Vie des Martyrs* and *Civilization*, were the outcome of his experiences. For *Civilization* Duhamel received the Goncourt Prize.

DUIKER, the pigmy bush, or forest, antelope of Africa. The Boer name, *duikerbok*, meaning "diving

goat," describes the plunge to cover when startled of these slender-legged little animals. Duikers vary in height from 14 to 30 in. at the shoulder, the largest (*Cephalophus sylvicultrix*) approaching the size of a donkey. Most of the 20 or more species are soberly colored, grayish-brown, or tawny red. The males have straight spiky horns with an upstanding tuft of stiff hair between them.

DUISBURG-HAMBORN, a city in the Prussian Rhine Province, formed in July, 1929, by uniting Duisburg and Hamborn. The merged city lies on the Rhine on both sides of the mouth of the Ruhr, from which the Rhine-Hamm Canal, leading from the Dortmund-Ems Canal, branches off. As Duisburg-Hamborn is near the great industrial region of the Ruhr, coal is loaded in the harbors of the city. The new municipality is a conglomeration of various towns with industrial plants situated between them and much vacant land. The port facilities are very extensive, there being about 20 mi. of river front, and form the largest interior port of the world; on an average 27,000,000 tons of goods are transhipped here annually. The city has the atmosphere of a thoroughly up-to-date industrial municipality. There are many huge factories and steel, gas and water works. Very few old buildings are left in the synthetic city, the one of note being the St. Saviour's Church, a late-Gothic edifice of the 15th century. The great progress of the city is due to its position as chief export harbor of the Ruhr coal. There are modern vocational schools and municipal theaters. Pop. 1925, 421,217.

DUKAS, PAUL (1865-), French music composer, was born at Paris, Oct. 1, 1865. He entered the Paris Conservatoire in 1881, and in 1888 won a second Grand Prix de Rome with his cantata, *Velleda*. Beginning with 1892, in which year the Lamoureux Orchestra, Paris, performed his overture *Polyeucte*, Dukas steadily rose to a unique position in French music by reason of his fresh and colorful orchestral compositions, his critical writings, and his influence as a teacher. He joined the Conservatoire faculty in 1909. In 1912 his ballet, *La Peri* was produced at the Opéra-Comique, Paris. His long list of compositions include, besides those mentioned, *Ariane et Barbe Bleue*, a three-act opera based on a tale by Maeterlinck, the overtures *King Lear* and *Gotz von Berlichingen*, a *Symphony in C Minor*, and piano works including a well-known *Sonata in E-flat minor*.

DUKE UNIVERSITY, a coeducational university, situated at Durham, N.C. It was founded in 1838 as Trinity College and entirely reorganized and renamed in 1924 after being made the chief beneficiary of the James B. Duke Endowment. The present university includes undergraduate colleges; a Graduate School of Arts and Sciences; schools of Law, Medicine, Religion, Engineering, Forestry and Dietetics; a Summer School, and a School of Nursing in connection with Duke University Hospital. The total assets in 1931 amounted to \$46,969,858. In 1930-31 Duke University enrolled 2,393 students, of whom 1,840 were full-time undergraduates. The faculty numbered

256 members, and was headed by Pres. WILLIAM P. FEW.

DU LHUT, DANILE GREYSOLON, SIEUR (1649-c. 1709), French explorer and Indian trader in New France, was born at Saint-Germain-en-Laye. Having enlisted in the royal guard, he served as a captain in Canada. He saw further military service on the Continent in the struggle between William of Orange and the French. Again in New France to follow the fur trade, he led a party from Montreal to Lake Huron in 1678 and pushed on to the western end of Lake Superior in 1679. He established friendly relations with the Sioux, and established the site of the present Duluth, Minn., at the mouth of the Pigeon River. Living among the Indians, he was influential in establishing peace among warring tribes to the benefit of the fur trade. In 1680 in the course of a journey on the Mississippi he released HENNEPIN and his fellows from the Sioux, who had been holding them prisoners. He was commandant at Ft. Frontenac in 1695. Du Lhut died about 1709.

DULONG AND PETIT'S LAW. See SPECIFIC HEAT.

DULSE, the name given to various red seaweeds more or less utilized for food on the northern coasts of Europe, Asia and Alaska. The dulse most commonly used in northwestern Europe is a coarse, purplish, leathery plant (*Rhodymenia palmata*).

DULUTH, a city in northeastern Minnesota, the county seat of St. Louis Co., situated on Lake Superior at the mouth of the St. Louis River, 156 mi. northeast of St. Paul. Several railroads, bus and truck lines and lake steamers serve the city. The harbor is an important shipping center for grain, coal, iron ore and automobiles; its traffic in 1929 amounted to \$485,631,945. The principal manufactures are steel and other metals, lumber, flour and meat products. In 1929 the total factory output was worth about \$58,000,000; the wholesale trade proper amounted to \$121,783,258, retail trade to \$56,334,718. Duluth is an educational center of northeastern Minnesota; the State Teachers College, a Catholic College and the Civic Service School are located here. It is the seat of Protestant and Catholic bishops. The city was founded by Daniel Greysolon, Sieur Du Luth, in 1679. It was incorporated in 1857. Pop. 1920, 98,917; 1930, 101,463.

DUMA, the lower house in the Russian Parliament before the Revolution, and officially known as the Imperial Duma. It was called into being by the Imperial Decree of Oct. 1905. The establishment of the Duma, which according to the rescript of the Tsar was to be elected by the people, grew out of the widespread demands for reform throughout Russia after the Russo-Japanese War. Revolutionary movements had spread into every part of the Empire of the Tsars, but it was particularly violent in the cities and among the non-Russian peoples like the Poles, Finns, Armenians and Georgians. The first Duma met in 1905, amid great enthusiasm, the Tsar opening it in person in the presence of a brilliant assem-

blage of diplomats, court and Government officials. On all sides people believed a new era of Parliamentary Government was beginning for Russia. Unfortunately the reactionary influences surrounding Nicholas II had no such idea, and the Duma itself was too inexperienced and too radical.

Several parties had been organized in preparation for the elections. The Octobrists, so-called because they were satisfied with the concessions made by the Tsar in the October Manifesto, its supporters coming from the nobles and capitalists; the Constitutional Democrats or cadets, who wanted further liberal reforms, the Social Democrats, "S.D.;" and a Labor Party, representing the peasants. Only the Social Revolutionists were not represented, having refused to take part in an election for an assembly provided by the Tsar. From the start the Duma made demands that seemed to the Tsar utterly incompatible with his prerogatives, as for example, immediate amnesty for all political prisoners, autonomy for Finland and Poland, land reforms and investigation of the mismanagement of the last war. On July 2 the Tsar dissolved the Duma, because it "would not co-operate with the Government."

The second Duma met in 1907. It was more radical than the first and after a stormy life of a little over three and a half months it too was dissolved. In the meantime the autocratic Government was again made independent of Parliament by its success in obtaining large foreign loans. It therefore defied and decided to get control of the next Duma by a basic change in the electoral law. The voters were divided into four classes, landowners, merchants, peasants and workmen, and to each was given a definite number of delegates in electoral colleges which chose the representatives to the Duma: to the landowners 60%, to the peasants 22%, to the merchants 15% and to the working group a meager 3%. On the basis of this electoral system the Third and Fourth Dumas were both dominated by reactionaries and landowners. The repression of the liberal movement was resumed, the Duma cooperating, or, when its members protested, serving chiefly as a forum for the voicing of opposition. The Tsar could prorogue or dissolve it at any time and, when it was not in session, he had the power to issue ordinances (ukases) which had the force of law. Nevertheless, the Duma promoted some very salutary legislation, notably the Stolypin land reforms. During the World War the Duma favored its vigorous prosecution, and in the spring of 1917, when things were seemingly at their worst, it was the Fourth Duma that took the initiative in demanding the abdication of the Tsar in Mar., 1917. With the establishment of the Provisional Government and the gradual spread of anarchy leading first to the Socialist dictatorship by Kerensky and, in November, to the usurpation of power by the Bolsheviks, the Duma faded out of existence.

BIBLIOGRAPHY.—Sir Bernard Pares, *Russia and Reform*, London, 1907; Ludwig Kulezicki, *Geschichte der russischen revolution*, 1910-1914, 3 vols. Gotha, trans. fr. the Russian.

DUMAS, ALEXANDRE or **DUMAS PÈRE** (1802-70), French novelist and playwright, whose real name was Alexandre Dumas-Davy de la Pailleterie, was born at Villers-Cotterets, July 24, 1802. His father, Gen. Thomas Alexandre Dumas, was the illegitimate son of the Marquis de la Pailleterie and a Negress of Haiti named Marie Cessette Dumas. The future novelist was left fatherless at an early age. His education was informal, and owing to his poverty he was forced to seek an uncongenial livelihood as a clerk in a small law office. A visit to Paris fired him with the ambition to make his fortune in that city, and eventually he obtained a position as clerk to the Duke of Orléans. Out of a union early contracted in Paris with Marie Labay, a dressmaker, an illegitimate son was born to him, later to be famous as **ALEXANDRE DUMAS FILS**.

The idea of writing plays had taken hold of Dumas, and, in collaboration with a friend, Adolphe de Leuven, he produced in 1823 *La Chasse et l'Amour*. Other plays followed in quick succession. But in 1844 Dumas turned to another field of literature, that of the historical romance, and here, with Sir WALTER SCOTT, he reigns supreme. The first of these productions was *Les Trois Mousquetaires*, or *THE THREE MUSKETEERS*. This novel was so immensely successful that Dumas followed it up with two sequels, *Vingt Ans Après* and *Le Vicomte de Bragelonne*. But so extraordinarily prolific was the novelist that in the same year as *Les Trois Mousquetaires* was published, *Le Comte de Monte Cristo* was also presented to a breathless public. (See *COUNT OF MONTE CRISTO*.)

From this time onward romances literally poured from the pen of Dumas, although to this day there is considerable controversy concerning how large a share the pens of collaborators played in these works. It is conceded that Auguste Maquet was an important collaborator; but the imagination and energy of Dumas were so remarkable that little importance can be attached to the popular accusation that he established a veritable novel factory, employing "hands" to produce romances on a given historical theme. The truth seems to be that his employees supplied him with the skeleton structures of romances, but that Dumas himself wrote the actual novels as read by the public. Of these many works the best known have been translated as *Queen Margot*, *The Lady of Monsoreau* and *The Forty-Five*, these being in the so-called Valois Series; and *The Chevalier of Harmental*, *Olympe of Cleves* and *The Black Tulip*. In 1852 Dumas published *Mes Mémoires*, in 20 volumes.

The last years of Dumas's life were somewhat embittered by poverty brought about by his immense expenditures. Fabulous as were the sums his romances earned for him, they failed to keep step with his Renaissance mansions and the prodigal liberality displayed towards his friends and their friends. As his debts accumulated, his literary powers began to flag and finally they gave out altogether. The great

romancer died at his son's house, near Dieppe, Dec. 5, 1870. See also *FRENCH LITERATURE*.

BIBLIOGRAPHY.—H. L. Parigot, *Alexandre Dumas Père*, 1902; A. F. Davidson, *Alexandre Dumas Père*, 1902; L. H. Lecomte, *Dumas*, 1904; H. Gorman, *The Incredible Marquis, Alexandre Dumas*, 1929; F. H. Gribble, *Dumas, Father and Son*, 1931.

DUMAS, ALEXANDRE, or **DUMAS FILS** (1824-95), French author, was born at Paris, July 27, 1824, a natural son of the elder Dumas by Marie Labay, a dressmaker. As soon as the elder Dumas met with success, he recognized his son legally. He made his literary début in 1847 with a volume of verse. The following year he published his novel, *La Dame aux Camélias*, which, when dramatized in 1852, met with immense success. This play, usually known in America under the title *Camille*, has continued its original success on both sides of the Atlantic; it is part of the repertoire of tragic actresses in every country. His fame established, Dumas strengthened it by a succession of brilliant pieces, of which *Le Demi-Monde*, *L'Ami des femmes*, *La Princesse George*, *Trois Hommes forts* and *Césarine* are the best known. All these plays have as their theme controversial social and moral problems, for Dumas was distinctly a propagandist and preacher. He was admitted to the French Academy in 1874. He died at Marly-le-Roi, Nov. 27, 1895.

BIBLIOGRAPHY.—H. S. Schwartz, *Alexandre Dumas, fils*, 1927.

DUMAS, JEAN BAPTISTE ANDRÉ (1800-84), French chemist, was born at Alais, Gard, July 15, 1800. In 1821 he became professor at the Athénée, Paris, later at his own foundation, the École Centrale des Arts et Manufactures and at the Sorbonne. His influence upon the development of chemistry, particularly through the developments which he gave the atomic theory, was considerable. His researches on organic compounds were likewise valuable, particularly his discoveries in the fatty acids and his work on the human blood. He died at Cannes, April 11, 1884.

DU MAURIER, GEORGE LOUIS PALMELLA BUSSON (1834-96), English illustrator and novelist, was born at Paris, Mar. 6, 1834, and educated in Paris and London. Each of his stories has an autobiographical element. In *Peter Ibbetson* fantasy is combined with recollections of the author's happy childhood at Passy. The school in *The Martian* is very like that which Du Maurier attended in Paris. The setting of *Trilby* savors of the happy-go-lucky Latin Quarter of his art-student days. For 36 years Du Maurier contributed to *Punch* drawings in which a gallant attitude towards lovely ladies was combined with keen, but kindly satire of the esthetic affectations of the times. He contributed to *Once a Week* and the *Cornhill Magazine* and did illustrations for Thackeray's *HENRY ESMOND*. Du Maurier was a skilled draughtsman with both words and pen and his self-illustrated novels have a unique charm. He died in London, Oct. 6, 1896.

DUMBARTON, a seaport of Dumbartonshire, Scotland, about 16 mi. northwest of Glasgow, on the Leven just before it joins the Clyde. It is a county town as well as a royal burgh. Of British-Celtic and Roman origin, before the growth of Glasgow it was the principal town of the Clyde valley. The Rock of Dumbarton, 240 ft. high, has been the scene of much local history. In 1305 William Wallace was held prisoner in the castle, and it is associated with Robert Bruce and the Stuarts. Mary Queen of Scots passed part of her childhood there before going to France. Substantially modernized, the town to-day has large facilities for building ships, making rope, and brewing. Pop. 1921, 22,933; 1931, 21,546.

DUMB-BELL, a weight used in physical exercise, consisting of two iron or wooden spheres connected by a short bar for a handle. It was in use in early Elizabethan days, and obtained its name from the resemblance of the balls to bells. The dumb-bell used in modern gymnasiums weighs from one to five pounds. In dumb-bell exercises two are employed. The weights are held in both hands, and the arms extended in a series of light calisthenic drills. These exercises are designed to develop every part of the body, and are widely used in schools of all nations. In trials of strength, iron dumb-bells have been cast which weigh 200 pounds and upward.

DUMFRIES, a royal burgh, and county town of Dumfriesshire, Scotland, lying on the Nith, about 81 mi. southeast of Glasgow, and 8 mi. from Solway Firth. After Roman withdrawal, its history is obscure, but by Robert Bruce's time is again traceable. James VI in 1617 presented the citizens with a marksmanship trophy that is still preserved in the picturesque old town hall. Dumfries is rich in associations with ROBERT BURNS who died there. Sir James M. Barrie attended the local academy. Modern Dumfries, a handsome town, manufactures hosiery, gloves, tweeds, automobiles and foodstuffs. Gardening and cattle marts are active. Pop. 1921, 15,778; 1931, 22,795.

DUMONT, a borough of Bergen Co., N.J., located 5 mi. west of Yonkers and 16 mi. north of Jersey City. It is served by the West Shore Railroad and motor bus lines. It is strictly a residential community and is the suburban home of many New York business men. Pop. 1920, 2,537; 1930, 5,861.

DUMPING, a term used in international trade to denote the practice of selling goods in one national MARKET at lower prices than in other markets, particularly in the home market. Fundamentally, dumping is a form of price-discrimination. It is usually done by an individual producer or association of producers, although, occasionally, it may be undertaken by a nation. Sporadic dumping is common as a means of disposing of a temporary surplus in one market without disorganizing other markets. As a permanent policy, however, it is used for two general purposes: to drive competitors from the market in which the dumping occurs; and to secure the advantages of large-scale production and sales without reducing prices in the domestic market.

While dumping has been utilized to some extent ever since the rise of modern commercial nations, as a systematic practice it is a comparatively recent development. The great cartels of Europe adopted it during the last quarter of the 19th century as part of their trade policy. German producers, in particular, seized upon dumping as one of the most effective means of stimulating their FOREIGN TRADE, and stabilizing their domestic sales. Other nations have not hesitated to use it when they could profit thereby, and there are exporters in England, France, and Japan, as well as in the United States, resorting to the practice.

Since the World War dumping has grown in disfavor because of the alleged dumping acts of Soviet Russia, although these operations do not differ from those of other nations except in that they are done directly by the state. The intense dislike to dumping arises from the fact that it is usually spasmodic and thus causes violent disturbances in the domestic market. It gives to the country in which dumping occurs an irregular supply of goods, alternate low and high prices, and requires continuous efforts to adjust home industries to a fluctuating foreign trade.

A. F. L.

BIBLIOGRAPHY.—Jacob Viner, *Dumping: A Problem in International Trade*.

DUNANT, JEAN HENRI (1828-1910), Swiss philanthropist, founder of the Red Cross Society, was born at Geneva in 1828. As the result of a visit to the scene of the battle of Solferino (1859), he established an organization to give aid to wounded soldiers. Publishing *Un Souvenir de Solferino* in 1862, constantly urging relief for the sufferings of war, he brought about the calling of the Geneva Convention in 1864, and through this, the official formation of the International Red Cross Society, in the establishment of which 10 governments cooperated. With the French statesman, Frederic Passy, he received in 1901 the first Nobel peace prize. He gave his entire fortune to various philanthropies. Among his writings are *Fraternité et Charité Internationale en Temps de Guerre*, *L'Esclavage chez les Mussulmans et aux États-Unis de l'Amerique*, and *La Rénovation de L'Orient*. He died at Heiden, Oct. 3, 1910.

DUNBAR, PAUL LAWRENCE (1872-1906), American poet, was born of Negro parentage at Dayton, O., June 27, 1872. He was educated in the public schools of Dayton, and on graduating was class poet. His first book of verse was *Oak and Ivy*, which he sold in the elevator he operated. Friends helped him publish *Majors and Minors*. He now used Negro dialect with great skill, and *Lyrics of Lowly Life*, 1896, made him famous. He decided to devote himself to writing in 1898, but the following year he was attacked by tuberculosis. He died at Dayton, Feb. 9, 1906.

DUNBAR, WILLIAM (c. 1460-c. 1525), Scottish poet, was born probably in East Lothian, about 1460. His poems, rich in imagination and humor, include

The Thistle and the Rose, an allegory written in 1503 in honor of the marriage of Margaret Tudor and James IV of Scotland, and *The Golden Targe*, also an allegory. The two satires, *The Dance of the Seven Deadly Sins* and *The Two Married Women and the Widow*, are generally regarded as Dunbar's best works.

DUNBAR, BATTLE OF, an engagement on Sept. 13, 1650, between the English under Oliver Cromwell and the Scots under David Leslie. Taking place 3 mi. from the town of Dunbar, Scotland, the battle depended chiefly on a flank movement executed by Cromwell on the right of the Scottish army, which had by far the better position. With half the number of the Scots Cromwell penned them between a hill and a ravine, where by their confusion the Scots contributed to their own destruction. They lost 3,000 men in killed and 10,000 as prisoners.

DUNCAN, ISADORA (1878-1927), American dancer, was born at San Francisco, Cal., May 27, 1878. She made her dramatic debut in 1895 at Daly's Theatre, New York City, afterward studying dancing at London and Paris. In 1900 she began to present her interpretations of the Greek dance. Her success on both sides of the Atlantic was an important factor in the 20th century revival of the ancient Greek dance. Her ideas were spread by pupils of the schools she founded at Berlin in 1904, at Paris in 1914, New York City in 1915, and at Moscow in 1921. In 1922, she settled in Paris and devoted herself to her school at Neuilly. Financial difficulties forced her to sell her property, and in 1924 she removed to Nice. She was killed there in an automobile accident, Sept. 14, 1927. An eloquent recital of her triumphs and trials is contained in *My Life*, an autobiography which appeared in 1927 soon after her death. See also DANCE, THE.

DUNCAN, a city of southwestern Oklahoma, the county seat of Stephens Co., situated 95 mi. southwest of Oklahoma City. The Chicago, Rock Island and Pacific Railroad and bus lines afford transportation. Duncan lies in an agricultural region producing cotton, feed crops and live stock. The resources include oil and natural gas. Pop. 1920, 3,463; 1930, 8,363.

DUNDALK, seaport and railway junction of County Louth, Irish Free State, near the outflow of the Castletown into Dundalk Bay, 54 mi. north of Dublin. At Dundalk Edward Bruce proclaimed himself king, and in its environs in 1318 he was killed by the English. The town's sole surviving antiquity is a ruined Franciscan priory. The port is much used by yachtsmen. Dundalk's commercial interests lie in flax and jute spinning, large railway and ship-building works, and brewing and distilling. Pop. 1926, 13,996.

DUNDEE, a royal burgh, seaport, and county town of Forfarshire, Scotland, about 59 mi. northeast of Edinburgh, overlooking the Firth of Tay and the Firth of Gowrie. Associated with Bruce and even earlier Scottish heroes, there is little to-day to remind of its ancient past. Dundee's progressive attitude is

shown by large parks, a good university, modern buildings, and a handsome town hall by Adam. Extremely wealthy in the 15th century, Dundee suffered severely at the hands of General Monk, and did not recover until the 18th century when the linen industry, which still persists, took on importance. In addition Dundee's modern activities are ship-building, engineering, fisheries, brewing, and large jute interests. The docks along the harbor are two miles long. Pop. 1921, 168,402; 1931, 175,933.

DUNE, a shifting, irregular hillock, or a continuous ridge of wind-drifted sand. Prevailing on-shore winds heap up these sandy ramparts along sea and lake coasts, or even in semi-arid regions, along rivers, as the Columbia, in Oregon. They ordinarily range from exaggerated ripple-marks to occasional heights of 50 to 75 ft. In Dunes Park, Indiana, at the head of Lake Michigan, sand hills rise 100 ft. or more high.

Unless anchored by vegetation, shore dunes tend to migrate inland. Particle by particle, the sand is blown up the steep seaward slope, dropping on the lee side and slowly moving the entire mass. Great coastal dunes along the Bay of Biscay progress at the rate of 16½ ft. a year. In many parts of the world advancing sands have gradually engulfed forests, farms, or even villages, necessitating government measures to check their incursions. At Provincetown, Massachusetts, large sums have been spent upon windbreaks and dune-plantations to stabilize the sand.

The sand storms of the Sahara and other deserts envelop vast dune areas, wherever some obstruction favors accumulation. Sometimes the sands encroach disastrously upon fertile oases. In northern Africa and in Asia, the ruins of ancient cities, such as Nineveh and Babylon, are buried under windblown sand.

DUNEDIN, the chief city of Otago province, New Zealand, situated on the southeastern coast of South Island about 8 mi. from its port, Port Chalmers, from which vessels of 16 ft. draught can ascend to Dunedin through Victoria Channel at low water.

Industries and manufactures are well-developed and include tanning and soap boiling. Kitchen stoves and gold dredges are manufactured on a large scale. The picturesque, well-planned city has a good medical school and Otago College, the largest institution for higher education in New Zealand. Dunedin, the old Gaelic name for Edinburgh, was established in 1848. Its rapid progress dates from 1861 when gold was discovered in Otago. Pop. 1931, 68,200.

DUNE DWELLERS, a name applied by N. C. Nelson, of the American Museum of Natural History, in 1925, to the Mesolithic and Neolithic inhabitants of the Gobi Desert, whose cultural remains he found in and around some large dunes bordering a basin formerly containing a lake. The location was half a mile from where the dinosaur eggs were discovered, and some fragments of these had been used in necklaces. Raphael Pumpelly, whose geological researches in China and Mongolia were published by

the Smithsonian Institution in 1866, noted cases where whole villages had been excavated in the bluffs of wind-blown loess.

DUNELLEN, a borough of Middlesex Co., N.J., located 28 mi. southwest of New York City and adjoining Plainfield on the west. It is served by the Central Railroad of New Jersey, electric trolleys and motor bus lines. Dunellen is mainly a residential suburb but also has a number of industrial establishments including railroad shops, plants devoted to printing, steel fabrication and the manufacturing of machinery. Pop. 1920, 3,394; 1930, 5,148.

DUNES PARK, a state park on the southern shore of Lake Michigan in northeastern Indiana. The park, established in 1925, comprises 2,185 acres which contain the greatest sand dunes on the continent. These sand hills are constantly shifting and traveling before the winds from the lake. Much of the area is wooded, and is interspersed with swamp meadows. The flora of the region is unique and of wide variety.

DUNFERMLINE, a royal burgh of Fifeshire, Scotland, about 18 mi. northwest of Edinburgh, situated upon a hill close to the Firth of Forth. Pittencrief Glen cuts through the town. Originally the site of a Culdee monastery, from the 11th century it was favored by Scottish royalty. Founded in 1072 by Queen Margaret and Malcolm Canmore, the abbey was burned in 1303 by Edward III, except for the nave which was used as the parish church till the 19th century and which now forms the vestibule of the New Church, built 1821. It is the burial place of the Scottish kings from Malcolm Canmore to Malcolm IV, as well as of Robert Bruce, Annabella Drummond (mother of James I of Scots), the Earls of Elgin and Kincardine, and others. Dunfermline is modernized by fine public works, many given by Andrew Carnegie, who was born in the town. Damask weaving, introduced in the 18th century, still prospers. Pop. 1921, 39,899; 1931, 34,954.

DUNKERS. See GERMAN BAPTIST BRETHREN.

DUNKIRK or **DUNKERQUE**, a seaport of northern France, department of the Nord. Commercially it is one of the most important cities in the country, and it is a fortress of the first class. It lies at the outlet of several navigable canals and possesses a fine natural harbor. Its trade is world wide. The town's most notable structure is its belfry of the 15th century with a famous carillon. During the World War Dunkirk, most of the time 18 mi. behind the Allied lines, was bombarded. Pop. 1931, 31,763.

DUNKIRK, a city on Lake Erie, in Chautauqua Co., western New York, about 40 mi. southwest of Buffalo. It is served by four railroads, lake steamers and bus and truck lines. Dunkirk is in the famous grape growing belt of New York. Steel, motors and valves are the chief manufactures. The retail business in 1929 amounted to \$7,942,861. The city was incorporated in 1880. Located here are Holy Cross College and several parochial schools. Pop. 1920, 19,336; 1930, 17,802.

DUNLAP, WILLIAM (1766-1839), American

painter, playwright and author, was born at Perth Amboy, N.J., Feb. 19, 1766. At 16 he began to paint portraits, numbering among his early sitters George and Martha Washington. In 1784 he went to London to study, but became interested in the theater. Returning to New York, he wrote and directed plays for some years; among his plays are *Leicester*, produced in 1794, *André*, 1798, and *The Italian Father*, 1799. Later he returned to painting and in 1816 helped to found the National Academy of Design where he was professor of historical painting. He wrote a number of histories and a novel. Dunlap was noted more for his versatility than for any single outstanding talent. He died in New York City, Sept. 28, 1839.

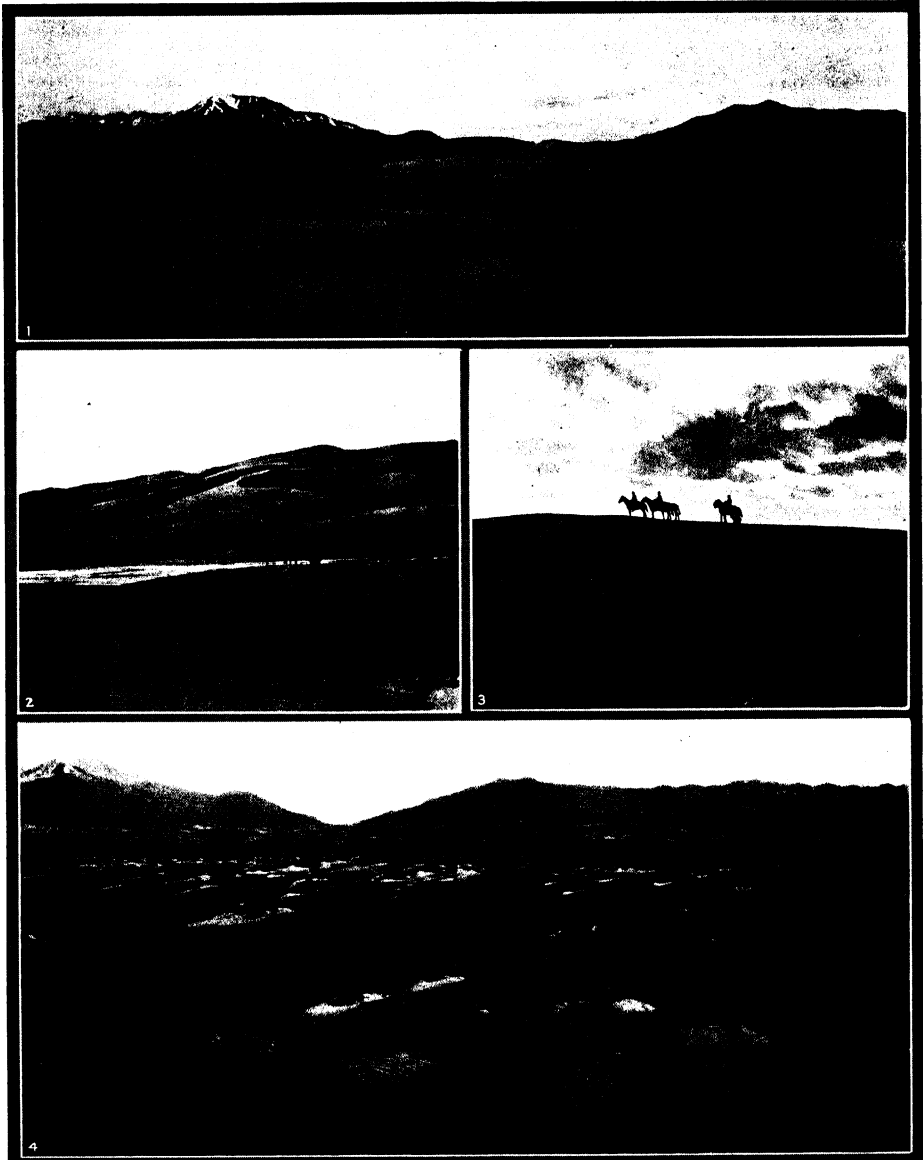
DUNMORE, JOHN MURRAY, EARL OF (1732-1809), English governor of Virginia. He succeeded to the peerage in 1756. He entered the House of Lords in 1761 and in 1770 he became Governor of New York. In 1771 he was made Governor of Virginia also. There he dissolved the assemblies of 1772, 1773 and 1774 because of revolutionary activities in connection with the burning of the *Gospee* in Boston and their reactionary attitude toward the British Government. In 1775 he precipitated an armed uprising in the colony by removing the powder from the magazine at Williamsburg. Retiring to a man-of-war off Yorktown, he issued a proclamation freeing all slaves who rallied to his cause. Hostilities continued, and he left Norfolk a pile of ashes to prevent the Colonial troops from building fortifications there, returning to England in 1776 to reenter the House of Lords. As Governor of the *BAHAMAS* he had more success, his administration from 1787-96 being quiet and peaceful. He died at Ramsgate, England, May, 1809.

DUNMORE, a borough three miles northeast of Scranton, in Lackawanna county, Pa. It is served by the Erie; Delaware, Lackawanna & Western and the Lackawanna & Wyoming Valley railroads. Its principal manufactures are silk, woolen and cotton products. Coal mining is an important industry throughout this section. In 1929 the retail trade of the borough reached a total value of \$3,634,321. Dunmore was founded in 1783. Pop. 1920, 20,250; 1930, 22,627.

DUNN, OLAV (1872-), Norwegian novelist, was born in Namdalen, north of Trondhjem, Nov. 21, 1872. His novels deal with peasant life, and most of them are written in the dialect of the region in which he was born. Chief among them are six novels telling the story of the Juvik family through several generations. The collective title of this work is *The People of Juvik*, and the separate titles are *The Trough of the Wave*, *The Blind Man*, *The Great Wedding*, *Fairland*, *Youth* and *The Storm*. Among his other works are *Three Friends*, *The Good Conscience* and a volume of short stories entitled *Ways and Byways*.

DUNNE, FINLEY PETER (1867-), American humorist, was born in Chicago, July 10, 1867, and educated in the Chicago public schools. After 12 years as a newspaper reporter he edited the *Chicago*

DUNE



1, 4, GEORGE L. BEAM PHOTOS; 2, 3, COURTESY CHAMBER OF COMMERCE, PUEBLO, COLO.

SAND DUNES OF COLORADO

1. The almost unbroken expanse of a Colorado sand dune.
2. Colorado has the largest inland shifting sand dunes known, the one pictured here being 1,000 feet high, 9

miles long and 6 miles wide. 3. Dunes of the San Isabel National Forest, southwest of Pueblo. 4. Wind-made ripples of a Colorado sand dune.

DUNE



COURTESY INDIANA DEPT. OF CONSERVATION

DUNE LANDS ALONG LAKE MICHIGAN

1. Sand and shore in Indiana Dunes State Park on the south shore of Lake Michigan.
2. A wind-swept shore line. Another scene in the Indiana Dunes State Park.

Journal in 1897-1900. During that time he created the character Mr. Dooley whose humorous observations on current affairs made in an Irish brogue, had national circulation and placed the author in the foremost rank of American humorists. These writings were published in collections, including *Mr. Dooley's Philosophy*, *Mr. Dooley's Opinions* and others. From 1917-19 Dunne served as editor of *Collier's* to which magazine he had long been a contributor.

DUNSANY, EDWARD JOHN MORETON DRAX PLUNKETT, LORD (1878-), English writer, was born in London, July 24, 1878. He served in the Boer and World Wars. His first play was *The Glittering Gate*, produced by the Abbey Theatre, Dublin, in 1909. Other plays include *The Gods of the Mountain*, 1911, *A Night at an Inn*, 1916, *The Queen's Enemies*, 1916, *If*, 1921, *Cheezo*, *Lord Adrian*, *Alexander and Other Plays*, 1925. *The Queen's Enemies* and *If* were produced by the Neighborhood Playhouse, New York City. Dunsany also wrote the tales: *The Gods of Peigana*, 1905, *The Sword of Welleran*, 1908, *Tales of Wonder*, 1916, *The Chronicles of Rodriguez*, 1922, *Evil Kettle*, 1926, and *Old King's Tale*, 1926.

DUNS SCOTUS, JOHN (c. 1265-1308), Franciscan monk and scholastic philosopher, was born about 1265, whether in Ireland, Scotland or England it is not known. In 1301 he was made professor of theology at Oxford and in 1304 at Paris. Here he defended so successfully the Immaculate Conception of the Blessed Virgin that he won the title "doctor subtilis." He was the founder of the school of Scotists and had a large following. He died at Cologne Nov. 8, 1308.

DUNSTAN, ST. (924?-988), an early Archbishop of Canterbury, was born near Glastonbury, England, about 924. He was the son of a Wessex noble and was reared at the court of Ethelstan, who later made him abbot of Glastonbury. During the reign of Eadred (946-955) he was royal advisor, but was exiled by his successor Eadwig. Edgar, the next king, recalled him, made him bishop of London and later Archbishop of Canterbury (959). He lost his influence at court when Ethelred II came to the throne in 978, because he opposed the king's marriage. He greatly favored the monks at the expense of the secular clergy and labored for the papal supremacy. He died at Canterbury, May 19, 988.

DUODENAL ULCER. See **PEPTIC ULCER**.

DUODENUM, that portion of the small intestine which is continuous with the stomach. The duodenum is about twelve finger breaths long, from which fact it derives its name. It is bent in the form of the letter C and encloses the head of the pancreas. It is fixed against the upper portion of the back wall of the abdomen, a little to the right of the middle line. (See **ALIMENTARY CANAL** for illustration.)

The cells of the lining membrane of the duodenum secrete two substances, secretin and entero-kinase. The former is carried by the blood to the pancreas,

causing it to empty its secretion into the intestine. Entero-kinase acts upon trypsinogen secreted by the pancreas and changes it into trypsin which is a protein-splitting ferment, necessary in the digestion of protein foods. (See **DIGESTION**.)

Running part way around the interior of the wall of the duodenum are prominent ridges which apparently increase the secretive and absorptive surface.

Affections of the duodenum are generally associated with those of the stomach. There may be simple or catarrhal duodenitis in which there is nausea and colicky pain toward the right of the midline two or three hours after meals. Suppurative duodenitis, following injuries, and ulcerative duodenitis are rare. Dilation of the duodenum may be due to compression of the further end of the duodenum by encroaching of the viscera or by peritoneal adhesions. Fixation of the duodenum by bands of tissue from the gall-bladder to the colon, by which the duodenum is lifted out of place, occurs in adolescence and is a surgical condition. Duodenal ulcer is by far the most important of duodenal affections and is generally associated with **GASTRIC ULCER**.

DUPLEIX, JOSEPH FRANCIS (1696-1763), French Governor General of the French East India Company, was born at Landrecies in 1696 and died in obscurity and want in France in 1763. His bold imagination and his organizing skill promoted his rapid advance until in 1741 he was appointed Governor General of the French Company in India. Unlike his predecessors in that post, Duplex had more than financial ambitions. His first military successes during the War of the Austrian Succession awakened in him the desire to transform the French East India Company into a great political power, to establish French control in India. By 1754 his achievements were prodigious, the Company holding or exercising influence over 30,000,000 native Indians and a stretch of territory twice the extent of France itself. A serious reverse in the Carnatic in 1752 caused him to call for reinforcements and to engage in heavy military expenditures, measures which gave his associates and the French government a pretext to recall him in disgrace. This act of folly, which was inspired partly by the French government's desire for peace with England and partly by its total misunderstanding of Duplex's achievements was ultimately to cost the French their control of India.

BIBLIOGRAPHY—P. Cultru, *Duplex*, A. A. Martineau, *Duplex et l'Inde Française*, 3 vols.

DUPLICATING MACHINES, appliances used in office work for making copies of written, printed or drawn material. Duplicates may either be copied from the original or they may be made simultaneously with it. In the former case photocopying and blue printing machines are generally used, while in the latter, automatic typewriters, stenciling machines, hectographs, typewriters and carbon paper, and machines which print from type are employed.

DUPLICATION OF A CUBE, a problem of antiquity requiring the construction of a cube whose

volume shall be twice the volume of a given cube. Its solution cannot be performed with ruler and compasses, for it depends on finding the cube root of 2, which cannot be done with these instruments. It can be solved, however, by the use of higher plane curves. See CURVES; CISSOID.

DU PONT, THOMAS COLEMAN (1863-), American manufacturer, was born in Louisville, Ky., Dec. 11, 1863. He studied at the Massachusetts Institute of Technology, engaged extensively in coal, and iron mining in Kentucky, and in 1902 became president of the E. I. du Pont de Nemours Powder Company. He was a member of the republican state committee of Delaware. In 1921 he became United States Senator and was reelected for the period 1925-31. He donated to the State of Delaware a concrete highway having a length of 98 miles. During the World War his company furnished the Allies about 40% of the explosives used by them. The company and its affiliates—manufacturing rayon, motion picture films, enamels and other chemical products, such as cellophane—has developed world-wide interests.

DUPONT, a coal mining borough in Luzerne Co. in northeastern Pennsylvania, situated about 8 mi. from Scranton. It is served by the Lackawanna and Wyoming Valley Railroad. Anthracite is the chief product. Pop. 1920, 4,576; 1930, 5,161.

DU PONT DE NEMOURS, PIERRE SAMUEL (1739-1817), French economist and statesman, was born in Paris, Sept. 14, 1739. He was one of the founders of the physiocratic school of economics. In 1774-76 he assisted Turgot with government finance, and in 1782 helped to negotiate the treaty recognizing the independence of the United States. Although twice president of the National Assembly and a member of the Institute, yet his activities particularly as regards supporting the king, caused Du Pont to be arrested in 1794, and he barely escaped the guillotine. He fled to the United States in 1799 where at the suggestion of Thomas JEFFERSON he drew up a plan of popular education that was later influential in France, although not adopted in America. He returned to France in 1802, but in 1815 came back to the United States, where his son's powder plant had already enriched the family. He died at Eleutherian Mills, near Wilmington, Del., Aug. 6, 1817.

DUPRÉ, JULES (1812-89), French landscape painter, was born at Nantes, Apr. 5, 1812. He worked in his uncle's china factory at Sèvres and received instruction in painting from a designer of clock faces. On a visit to England he was greatly impressed by the work of Constable. A prominent member of the BARBIZON SCHOOL, Dupré stressed the dramatic side of nature and his canvases are characterized by stormy, wind-swept skies and seas. He died at l'Isle Adam, Oct. 6, 1889.

DUQUESNE, a steel-manufacturing city in Allegheny Co., southwestern Pennsylvania, situated on the Monongahela River, 12 mi. southeast of Pittsburgh. It is served by the Pennsylvania Railroad and by river craft. The city has a large foreign-born population,

mostly from eastern and central Europe. During 1927 the output of Duquesne steel industries was 950,000 tons of merchant bars, 1,500,000 tons of ingots and 1,200,000 gross tons of pig iron. In 1929 the retail trade reached a total of \$5,662,801. Settlement began about 1885; Duquesne became a borough in 1891 and a city in 1917. Pop. 1920, 19,011; 1930, 21,396.

DUQUESNE UNIVERSITY, a Catholic coeducational institution founded in 1878 at Pittsburgh, Pa. It is conducted by the Holy Ghost Fathers and comprises a preparatory school, a College of Arts and Sciences, schools of Law, Finance, Commerce and Accountancy, and pharmacy, pre-medical and pre-dental, oratory, music, education, graduate, extension and summer-school courses. The library contains 20,456 books. The university is administered jointly by a non-sectarian board of laymen and a faculty of 156, headed by the Very Rev. Martin Hehir. In 1931-32 there were 2,430 students.

DU QUOIN, a city in Perry Co., southern Illinois, situated about 70 mi. southeast of St. Louis. Bus lines and the Illinois Central Railroad serve the city. There is an airport. Du Quoin is in an important coal-mining region and has some of the largest strip coal mines in the country. The chief industrial interest is mining. Oats, corn and hay are the principal crops of the region. Du Quoin, founded in 1850, was incorporated in 1872. Pop. 1920, 7,285; 1930, 7,593.

DURALUMIN. See HEAT TREATMENT; ALUMINUM, ALUMINUM ALLOYS.

DURAMEN, the botanical term applied to the hard inner portion or heartwood of a tree as distinguished from the outer softer layer called sapwood or alburnum.

DURAN, known also as Durant, Durante and Dorant, famous Jewish family of rabbis, commentators, and rabbinical and apologetic authors which flourished originally in Provence, Southern France, from the latter part of the 14th to the beginning of the 16th century. Many of its members later settled in Northern Africa. The family was still in existence in the 18th century.

Of especial importance was Profiat Duran, a Marrano physician, historical writer, astronomer and grammarian, who was born in Aragon but fled to Palestine in order to free himself from the compulsory baptism which he had to accept during the terrible 1391 persecutions of the Jews in Catalonia. When his friend David Bonet Bongiorno tried to persuade him to remain faithful to Christianity, Profiat wrote as answer to him the famous masterpiece of subtle satire and polemics called *Alteca Boteca*, a corruption of the original Hebrew title *Al Tehi Kaabothecha*, or *Be Not Like Your Fathers*. It is a bold attack on Christianity and the finest bit of anti-Christian satire ever written. Its irony and its satirical injunctions were so cleverly employed that for a long time the Christians themselves actually employed it as an apology for Christianity. Profiat was the author likewise of an astronomical work and of a Hebrew grammar.

Simeon Ben Zemah Duran, called Rashbatz, rabbi in Algiers, physician, mathematician, and Biblical and Talmudic commentator, was born at Palma, Majorca (Balearic Isles), in 1361. He was the first rabbi of Spain to accept pay for the fulfillment of his rabbinical duties, excusing his action on the ground of his poverty and the impossibility of making a living as a physician in Algiers. In 1391 he fled from Majorca to Algiers due to the violent persecutions, after having lost his entire fortune. In 1394 he became Isaac ben Sheshet's successor as the chief rabbi of Algiers. Duran died at Algiers in 1444.

His works include commentaries on the Bible and Talmud, rabbinical opinions, admonitory essays, responsa, and the *Magen Aboth*, or *Shield of the Fathers*, written about 1423. It contains a chapter entitled "Kesheth Umagen," or Bow and Shield, in which he defended Judaism against Christianity and Islam. He confirmed the theory of Profiat Duran and older writers that it was not Jesus's intention to abolish Judaism and the Jewish law, and stated that Jesus was not a descendant of the house of David.

Solomon ben Simeon Duran (1400-67), a son of Simeon ben Zemah Duran, succeeded his father to the rabbinate of Algiers. A rationalistic interpreter of Judaism and an opponent of Cabala, he wrote a work in defense of the Talmud against the false attacks of the baptized Jew Geronimo de Santa Fe; it contained a refutation of the principal arguments and doctrines of the Christian faith.

Solomon's son was Simeon ben Solomon Duran II, who lived at Algiers, where he was rabbi from 1439-1510. He was instrumental in redeeming many Jewish refugees from slavery, and wrote elegies and rabbinical responsa or answers to legal and ritual questions. A. Sh.

See Graetz, *History of the Jews*, 1926.

DURAND, ASHER BROWN (1796-1886), American painter and engraver, was born at Jefferson Village, N.J., Aug. 21, 1796. He was apprenticed to the engraver, Peter Maverick, in 1812, and his engraving of Trumbull's *Declaration of Independence* directed attention to him. After 1835 he abandoned engraving for portrait painting, numbering among his sitters several presidents of the United States. He was president of the National Academy of Design, which he helped to found, in 1845-61. After a visit to Europe in 1840, Durand dealt chiefly with landscape painting, and with THOMAS COLE, founded the HUDSON RIVER SCHOOL OF LANDSCAPE PAINTING. His *Mountain Forest*, in the Corcoran Gallery, Washington, and *In the Woods*, Metropolitan Museum, New York, are among his best landscapes. Durand died at Jefferson Village, N.J., Sept. 17, 1886.

DURAND, CHARLES AUGUSTE ÉMILE.
See CAROLUS-DURAN.

DURANGO, a state of central Mexico and one of the largest and richest districts of the republic, with an area of 42,272 sq. mi., and a mean elevation of about 5,000 ft. A large part of the state is mountainous, rising to peaks from 7,000 to 10,000 ft. high in the

western part. The mountains are covered with forests and interspersed by wide fertile valleys where game abounds. It has been called the hunters' paradise. An unusual surface feature is the great iron mountain which rises 700 ft. above the surrounding plain and is more than a mile long and composed of almost pure iron. The climate is dry and healthful, and varies with the altitude. Under irrigation the state produces cotton, grain and fruit. Mining is the chief industry, and extensive deposits of iron, gold, silver and copper are found within its borders. The capital is Durango; other cities are Lerdo Mapimi and Gomez Palacio. Pop. 1921, 336,766; 1930, 395,807.

DURANGO, a city of west central Mexico and capital of the state of the same name, is situated on the Funal River, in the Old Guadiana valley, about 96 mi. from Torreón, at an elevation of about 6,300 ft. above sea level. It is the distributing point for a large agricultural and mining district. Its industrial plants include box factories, lumber mills, foundries, tanneries, cotton mills, and an old mint. The cathedral, of Tuscan architecture, was begun 1695 and completed in 1750. Other notable buildings are the casino, municipal building, Juarez Institute and a market. Near the city rises the famous mountain of iron, 700 ft. above the surrounding country. It is composed of about 60% pure iron, is one mile long and of unknown depth. In 1532 explorers sent out by Governor Guzman, in search of reported silver, reached this place, but became discouraged and returned to Guadalajara; 20 years later another expedition sent out for the same purpose was ambushed and slain by the Indians. The city was founded about 1560 by Alonzo Pacheco, under the governorship of Francisco de Ibarra, who gave Durango its name. The city is also named Ciudad de Victoria. Pop. 1930, 32,719.

DURANGO, a city in southwestern Colorado, the county seat of La Plata Co., situated on the Animas River, 330 mi. southwest of Pueblo; served by motor buses and two railroads. The city is a trade center for a district highly productive in coal, oil and gas, timber, grain, fruit and truck crops. Smelting and lumber milling are the chief local industries. Just north of the city is San Juan National Forest, a summer range for thousands of cattle and sheep. Sixty miles west is MESA VERDE NATIONAL PARK, noted for the remains of the cliff dwellers. Near by, at Hesperus is a branch of the State Agricultural College, the Fort Lewis School of Agriculture. Durango was founded as a railroad town in 1880 and incorporated in 1881. Pop. 1920, 4,116; 1930, 5,400.

DURANT, WILLIAM CRAPO (1861-), American manufacturer, was born Dec. 8, 1861 in Boston, Mass. He received his education in the public schools at Flint, Mich., and founded there the Durant-Dort Carriage Company. He was the organizer of the Buick Motor Car Company (1905) and the General Motors Company (1908), holding controlling interests in the latter from 1915 to 1920. Previously he had purchased several large motor

companies. The Chevrolet Motor Company was also organized by Durant and he held controlling interest in it until Nov. 1920. The following year the Durant Motors, Inc. was established.

DURANT, a city in southeastern Oklahoma, the county seat of Bryan Co., situated about 100 mi. northeast of Dallas, Tex. Bus lines and three railroads afford transportation. There is a landing field. The region is fertile agricultural land, producing cotton, corn, oats, peanuts and potatoes. Durant is a shipping point for these crops, and also manufactures cotton and lumber products. Northwest of the city are beautiful rock formations and waterfalls. The natural springs are associated with Indian days. The ruins of Ft. Washita are in the vicinity. Located in Durant are the Southeastern State Teachers College of Oklahoma and the Oklahoma Presbyterian College for Girls. Pop. 1920, 7,340; 1930, 7,463.

DURAZZO, the chief port of the kingdom of ALBANIA, situated at the base of Mt. Durazzo. The ruined Byzantine citadel and the new summer palace of King Zog are landmarks. The harbor, excellent in former times, is now almost unapproachable because of the sand bars which fill it. But Durazzo is still a busy town, a port of call of all the liners traversing the Adriatic. An Albanian American school of agriculture was founded at Kavaja near Durazzo in 1925. Founded in the 7th century B.C. by Corinthian and Corcyrean colonists and known as Epidamnus, under the Romans its name became Dyrrachium and it was made the main landing point for their armies as well as the western terminus of the historic Via Ignatia highway which led to Salonika on the Aegean. Governed by Sicilians, Venetians and Serbians, and repeatedly attacked by the Bulgars, in 1501 the city was taken by the Turks and was not redeemed from their rule until 1913 when Essad Pasha made it the capital of the new Albanian government. A year later Prince William of Wied landed there as King of Albania, only to flee three months afterward. Large quantities of the picturesque costumes of the natives are made in Durazzo. Among other industries are salt and brick making. Grains, hides, sheep, olive oil and tobacco are exported. Most of the inhabitants are Moslems. Pop. 1930, 8,739.

DURBAN, the chief port of the province of NATAL, Union of South Africa. It is situated at the mouth of the Umgeni River, the sand bar of which has been removed so that 36 ft. of water are available for the largest vessels to come alongside the wharves. There are grain elevators, tea warehouses, sugar factories and several other industries, including whaling. Founded in 1834, Durban is now an excellent port and an increasingly popular holiday resort for the people of the Rand. Pop. 1921, 151,642, including 58,085 Europeans; 1931, Europeans, 86,271.

DÜREN, a manufacturing town in the Prussian Rhine Province, located on the Roer near Aachen. It employs 7,200 men in the production of paper, metal goods, glass, sugar and chemicals. It is well-equipped with educational, charitable, and cultural facilities.

Among its buildings are part of the old walls, a Gothic church of the 13-16th centuries, Gewandhaus, 1450, and Kornhaus, 1588. In Düren was an old castle where the Frankish kings and Charles the Great held diets. The city was burned in 1543 by an army of Charles V, became French in 1801 and Prussian in 1814. Pop. 1925, 37,180.

DÜRER, ALBRECHT (1471-1528), German engraver and painter, was born at Nuremberg, May 21, 1471. He studied with Michael Wohlgemut, a painter, and traveled extensively, going to Italy in 1494. His encounter with the classic spirit in Italy was particu-



COURTESY METROPOLITAN MUSEUM OF ART

SAMSON AND THE LION

From a woodcut by Albrecht Dürer

larly important. Dürer, whose life span covered the period from the invention of printing to the Reformation, fused Renaissance refinements with the vigorous, rugged Gothic tradition of Germany. The cheap, printed picture book also played an important part in Dürer's development, for it was as a wood block designer that he first showed his power and imagination. The *Apocalypse* wood cuts, of which the Four Horsemen is the most famous, appeared in 1498. After a second Italian visit, Dürer settled in Nuremberg, where he was patronized by the Emperor Maximilian. The years 1507-11 were occupied by painting, those from 1511-14 with the execution of the *Little Passion* wood cuts and copper-engravings. In 1513-14 appeared *The Knight, Death and the Devil*, *Melancholia* and *St. Jerome in his Study*, copper-engravings which

DÜRER



COURTESY METROPOLITAN MUSEUM OF ART

"THE NATIVITY"

By the greatest of all German engravers and founder of the German School, Albrecht Dürer (1471-1528).

ave been called "the masterpieces of the greatest mind hat ever expressed itself in this form of art." Dürer's outstanding paintings are the *Self Portrait* and the anels of the *Four Apostles*, at Munich, and the superb portraits of *Hieronymus Holzschuher*, at Berlin, and f *Hans Imhoff*, at Madrid. Dürer died at Nurem-erg, Apr. 6, 1528.

DURESS, compulsion by which a person is made o do something because of threats of which he is afraid. The threats may be against the person, his wife, children or property, but they must be said or lone in such a way as to influence a normal mind. A threat to do something the law permits is not duress, though it accomplishes its purpose through fear.

DURHAM, JOHN GEORGE LAMBTON, FIRST EARL OF (1792-1840), was born, Apr. 12, 792. He was the son of William Henry Lambton of Lambton Castle, Durham, and Anne Barbara Villiers, daughter of the fourth Earl of Jersey. Enormously wealthy in his boyhood, Lambton entered Parliament as a radical Whig in 1813 and at once distinguished himself as a partisan of political and religious reform. In 1816, by his second marriage he became the son-in-law of Lord Grey and in 1828 he was himself elevated to the peerage. His first efforts were failures, but as Lord Privy Seal of Grey's cabinet in 1830 he played an exceedingly important rôle in the passage of the Reform Act of 1832. During the next five years he was popularly regarded as Lord Grey's successor, but the deficiencies of his violent temperament and the radicalism of his political opinions aroused the enmity of Lord Brougham and cost him the support of Melbourne and Palmerston. In 1833 he was created Earl of Durham and Viscount of Lambton. His remarkable activities as Governor General and Lord High Commissioner in Canada (1837-39) and his famous Report on Affairs of British North America (1839) left permanent marks on the course of English colonial policy, laying down all the principles subsequently adopted by the government. He died July 28, 1840.

BIBLIOGRAPHY—Stuart J. Reid, *Life and Letters of the First Earl of Durham*, 3 vols.

DURHAM, a cathedral city and county town in Durham, England, situated mainly on a peninsula in the Wear River, 254 mi. northwest of London. Buses and the London and North-Eastern Railway afford transportation. Important coal fields are found nearby. Durham was founded in 995 by the monks of Lindisfarne. It is renowned for its cathedral. (See **DURHAM CATHEDRAL**.) Durham Castle, erected by William the Conqueror and later used by the bishops, is now a part of the University of Durham. Pop. 1921, 17,346; 1931, 16,223.

DURHAM, a city and county seat of Durham Co., northern North Carolina; it is situated 26 mi. northwest of Raleigh. Bus lines, truck lines and four railroads serve the city. Tobacco, cotton, and corn are the important crops of the region. Durham is one of the largest trade markets and manufacturing centers for tobacco in the world; it is the birthplace of James

B. Duke, tobacco magnate. Hosiery and cotton textiles are also manufactured. In 1929 the value of the factory output was about \$137,000,000; the retail trade amounted to \$20,607,421. Near the city is Bennet Memorial, marking the scene of Gen. Johnston's surrender to Gen. Sherman at the close of the Civil War in 1865. Durham is the seat of Duke University, formerly Trinity College, and the North Carolina College for Negroes. The city was incorporated in 1869. Pop. 1920, 21,719; 1930, 52,037.

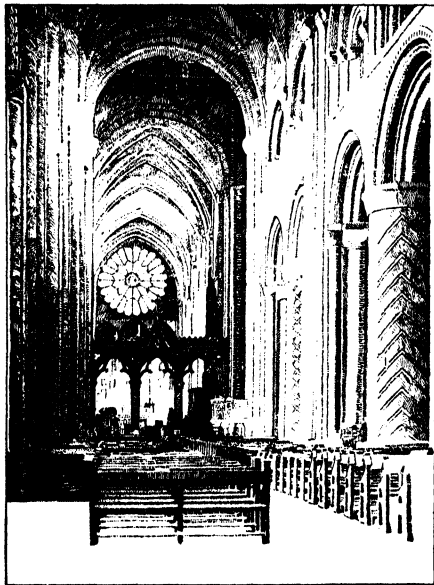
DURHAM, PALATINE COUNTY OF. An ecclesiastical state, roughly coterminous with the present county, in which, from the period of the Norman Conquest, the bishops of Durham exercised regal rights. In general, the Conqueror's division of England into fiefs created no great *appanages*; the lords of which might rival the royal power. The chief exceptions were the bishopric of Durham and the earldoms of Shrewsbury and Chester and palatine jurisdictions situated on the frontiers, whose holders were granted extensive powers because of their extraordinary responsibilities. The bishop's council handled the judicial affairs of the palatinate; his steward, with subordinate officers, administered the county; and there was an assembly dealing chiefly with fiscal matters. The Tudors endeavored to reduce the powers of the palatine bishops; the Long Parliament in 1646 abolished the palatinate, but it was restored under Charles II. In 1836 palatine jurisdiction was taken from the bishop of Durham and vested in the Crown.

DURHAM, UNIVERSITY OF, at Durham, Durhamshire, England, a coeducational university founded in 1832. It is housed in the imposing Durham Castle, built originally by William the Conqueror in 1072, and includes the following colleges: Hatfield University, Bede's, St. Chad's, St. John's, and—for women—St. Mary's, St. Hild's and Neville Cross. In 1908 the university was reconstituted to include another division at Newcastle-upon-Tyne made up of Armstrong College, founded in 1871, for science and commerce; and the College of Medicine, affiliated to Durham University since 1852. The total number of students in both divisions is about 1,500 annually. In 1931 the chancellor was the Most Hon. the Marquess of Londonderry.

DURHAM CATHEDRAL, Durham, England, one of the greatest churches in England, is among the most interesting cathedrals of the world. An imposing Norman church, it was built to serve as the seat of a bishop who was a great military feudatory as well as a spiritual lord. Erected on a turbulent border in a turbulent period, it is aptly described as "half house of God, half castle 'gainst the Scot." Its military aspect is unique among English churches, and its position above the river is one of extraordinary impressiveness.

A Saxon church was built here in the 10th century as the mausoleum of St. Cuthbert. The present cathedral was begun in 1093. It is the contention of certain critics, who claim that the problem of con-

structing an oblong vault over a central aisle was first solved here, that this Norman cathedral anticipated the Gothic. The nave, broad and high, is solemnly impressive. Clustered columns alternate with massive



NAVE OF DURHAM CATHEDRAL

ornamented piers and the proportions in the elevation of triforium and clerestory are singularly pleasing.

The galilee, which is in this instance a western lady chapel, was added about 1175. According to Francis Bond, legend avers that when the bishop began to erect a lady chapel "in the usual position to the east of the choir, St. Cuthbert, who had an ultra-monastic hatred of womankind, and would not brook to have the chapel even of Our Lady in the neighborhood of his shrine, showed his displeasure openly by the fissures and cracks and settlements which kept constantly appearing."

The so-called Chapel of the Nine Altars, which forms a terminal east transept, is a striking piece of late 13th-century building. Durham was badly restored in the 18th century and much ancient work was destroyed.

DURHAM'S REPORT, the epochal *Report on the Affairs of British North America*, submitted to the Crown by Lord Durham in Feb. 1839, the recommendations of which became the basis of the **UNION ACT OF 1840**. Lord Durham, appointed governor-in-chief of all five British provinces in North America in the critical period following the **REBELLION OF 1837**, was commissioned to suggest constructive measures which would prevent a recurrence of the disaffection. His personal commitments were to the

principles of self-government and to an enlightened, perpetuated British Empire. The report hopefully outlined the development of an Imperial structure based on colonial autonomy. Notwithstanding that his residence in Canada had been cut short after only five months, Durham offered a penetrating analysis of Canadian affairs, particularly brilliant in his summation of social and economic factors in Lower Canada. He sweepingly condemned the oligarchic governments as he had found them at Quebec and Toronto, and urged the establishment of responsible self-government in all colonial concerns, with the powers essential to the maintenance of the unity of Empire reserved for the Crown. These reserved powers were for the control of foreign relations, the regulation of commerce, the approval of the constitutions of government, and the disposal of the public lands. The union of Upper and Lower Canada under one government was urged, as a means of assimilating the French groups into the English population. He recommended representation by population in the Union Parliament, and the gradual substitution of the English language for the French. The report advocated the immediate development of municipal institutions, to serve as a political training school, and a comprehensive program of internal improvements to facilitate the growth of national spirit.

DURIAN (*Durio zibethinus*), a large somewhat elmlike tree of the sterculia family native to the Indo-Malayan region and extensively cultivated for its luscious fruit. It grows from 60 to 80 ft. high with oblong, taper-pointed leaves, yellowish-green flowers and large, usually oval fruit, about 10 in. long, enclosed in a hard rind completely covered with strong prickles. The fruit contains numerous large seeds enveloped in a delicious cream-colored pulp.

DURRA (*Holcus Sorghum* var. *Durra*), a grain-bearing sorghum or millet, widely grown as a food plant throughout Asia and also in Egypt and southern Europe. It is a stoutish annual with a dry pith and a compact, mostly recurved flowering panicle, bearing large, usually globose grain. There are several variant forms, among which are yellow milo and Jerusalem corn.

DURUY, JEAN VICTOR (1811-94), French historian and statesman, was born in Paris, Sept. 11, 1811. Educated in the École Normale Supérieure, he served for years as a professor of history in the Collège Henry IV in Paris, establishing at the same time his reputation as a historian. From 1863 to 1869 he was minister of public education. Among his innovations was the introduction of the study of modern history in the lycées and colleges. He also enlarged the curriculum for the education of girls. He became a senator in 1869, and in 1884 was elected a member of the French Academy. His outstanding work is the *Histoire des Romains depuis les temps les plus reculés jusqu'à la mort de Théodose*, 7 vols., 1879-85. He died in Paris, Nov. 25, 1894.

DURYEA, a mining community, a borough in Luzerne Co., in northeastern Pennsylvania situated on

the Susquehanna River, 8 mi. southwest of Scranton; it is served by the Lackawanna Railroad. Anthracite coal is the principal product. Pop. 1920, 7,776; 1930, 8,503.

DUSE, ELEONORA (1859-1924), Italian tragedienne, was born at Vigevano, Oct. 3, 1859. Her first recognition came in Naples in 1878, in Émile Augier's *Les Fourchambault*. She toured Europe in 1892-1897, and was generally acknowledged by Continental critics as one of the greatest actresses of her time. Her celebrated rôles were in plays by Ibsen, Sudermann and d'Annunzio. In Paris in 1897 she took Sarah Bernhardt's rôle in *La Dame aux Camélias*. In 1897 she met GABRIELE D'ANNUNZIO, and devoted herself wholly to his plays, suffering losses thereby, particularly on her American tour in 1902-03. The pair became estranged in 1899; when d'Annunzio's novel *Fuoco* appeared it contained much of Duse, including some of her eloquent letters. She retired in 1909, but financial losses compelled her reappearance, and in 1921 she played *The Lady of the Sea* at Turin. She made appearances at London in 1923 and in America in 1924. At Pittsburgh, Pa., she caught a cold, and died there, Apr. 21, 1924. The Italian warship *Duilio* conveyed her body to Italy where national mourning was proclaimed.

DUSK, the short transitional period between sunset and complete darkness. See TWILIGHT.

DÜSSELDORF, a city in Rhenish Prussia, situated on the Rhine about 20 mi. north of Cologne. Aside from the old part of the town, it is regularly laid out. In the 16th century the dukes of Berg lived there, and, after their extinction in 1609 it was the residence of the princes of the Palatinate, who transferred their residence to Mannheim in 1716. Although very important as an industrial and trade center the city owes its fame primarily to the Art Academy, founded in 1767. There are several old churches of note, a Rathaus of 1567, and an old tower on the Rhine, the remains of the ducal castle. Many galleries, exhibitions and artistic and learned societies are found in Düsseldorf. Heinrich Heine was born here in 1797. Pop. 1925, 432,633.

DÜSSELDORF SCHOOL OF PAINTING, an academy of art, with director and professors, founded in 1767 in the Prussian village of Düsseldorf, on the Rhine. An artistic center devoted to religious and landscape painting, its first notable director was PETER VON CORNELIUS (1819-25). His successor, FRIEDRICH WILHELM SCHADOW (1826-59), infused into accurate German draftsmanship a diluted strain of French Romanticism. Students flocked to the academy from all sides and learned to paint pleasant landscapes having no local or individual quality, which might have been painted anywhere. These, and genre painting of picturesque and virtuous peasantry, were produced in great quantity and exported principally to America. Music, drama and poetry formed a sentimental and romantic background to the imaginatively conceived painting executed without models. Mendelssohn, the musician, lived there for two years, and Immerman

directed performances of picturesque drama and opera. Among the leading painters of the school were the Achenbach brothers, Karl Lessing, Karl Sohn, Alfred Rethel, Ludwig Knaus and Julius Hübner.

DUST, atmospheric, the impurities in the air of a non-gaseous nature and usually solid. They may be of organic or inorganic origin. Among the former may be found spores of plants, bacteria and various other micro-organisms. The latter variety includes salt particles from the ocean spray; finely divided ashes from volcanic eruptions, as well as from volcanic fumes; the burnt remains of the numerous small meteors that strike the earth daily; minute sand particles whipped up from the desert by the wind; many waste products of the combustion of fuel, such as carbon, soot, ashes and liquid tar, and other products incident upon civilization.

Nowhere is the air free of these impurities, containing above the open ocean at least a thousand, and in the smoke-polluted atmosphere of big cities probably millions of dust particles per cubic inch. Part of them, such as soot, repel water; others, such as the minute crystals of salt form the nuclei upon which water vapor can, and without which it cannot, condense into drops. The visibility and the transparency of the atmosphere depends largely upon dust, the size of the particles in the ordinary haze being estimated at 1/50,000 inch if it is a dry haze, but at ten times that amount when they are moist.

Real scattering of sunlight takes place only when the size of the dust particles approaches the wave length of light, and is then proportional to the fourth power of the wave length. It has been estimated that quantities of volcanic dust in the atmosphere might well reduce the amount of sunlight penetrating to the earth to a small fraction while leaving the outward flow of terrestrial radiation practically unaltered, and it has thus been suggested that such might account for the Ice Ages. W. J. L.

DUST, in mines. Both coal and rock dust are made during the use of cutting and loading machines, drills and explosives. Air currents spread an impalpable coal dust through coal mines, which, if not anthracitic, constitutes a distinct explosion menace. Dust from cutting machines is termed "bug dust." See also EXPLOSIONS, DUST.

DUST COLLECTORS, mechanisms for removing fine particles of solid materials from the gases used in, or produced by, industrial or commercial operations. Their use is of importance in eliminating the smoke nuisance of industries and in cleaning the air used in commercial processes, in internal combustion engines, and in air compressors. Most of the dust collecting devices separate the foreign particles either by reducing the velocity of the gases, by decreasing their temperature, by employing centrifugal force and gravity, or by a combination of all three methods. All but the finer particles may be precipitated by reducing the velocity to about 2 feet per second. This process is usually used in large flues of great length. The bulkier particles of dust are easily separated by an

abrupt change of direction coupled with a sudden decrease of velocity, or by the use of "cyclones," or circular chambers in which the dust is thrown out by centrifugal force, being caught in a hopper below the stream of gas.

There are other dust collectors which subject the gases to rapid changes of direction in a small space, which catch the dust on oil-covered, hollow cylinders of metal, which screen it out by means of cheesecloth or loose-textured felts, that precipitate it on plates or wires by means of an electric field, as in the Cottrell precipitator, the dust being collected into hoppers by the force of gravity.

Dust collectors are made in sizes ranging from the small chambers used for cleaning the intake air on tractors and automobiles to the exceedingly large flues used in some of the western smelting plants, their length sometimes extending for thousands of feet.

G. A. O.

DUSTY MILLER, a name given to various ornamental plants with conspicuous ashy gray or white, woolly foliage. Among the most widely cultivated plants so named are the mullein-pink or rose campion (*Lychnis Coronaria*) and the beach wormwood (*Artemisia Stelleriana*). Various species of *Centaurea* are called dusty miller, especially *C. Cineraria*, as is also the woolly groundsel (*Senecio Cineraria*).

DUTCH BORNEO. See BORNEO: *Dutch Borneo*.

DUTCH DRAMA. The earliest record of Dutch drama is the Hulthem manuscript in the Royal Library at Brussels containing ten playlets which were probably written about the middle of the 14th century. One is a debate of Winter and Summer, six are farces of low life, the plots of which are similar to those of the medieval *fabliaux*, and three are dramatizations of subject matter akin to the romance of chivalry. Two of this last group have been translated into English: *Lancelot of Denmark* by P. Geyl, and *Esmoreit* by H. M. Ayres (*The Dutch Library*, Nos. I and II). These plays are the earliest examples in medieval literature of purely secular drama. There are contemporary French plays not unlike *Esmoreit* and *Lancelot*, but these belong to the category of the *miracle play* (see MYSTERY PLAYS), as they always introduce the Virgin Mary as a *dea ex machina*. The earliest Mysteries and Miracle plays in Dutch date from the 15th century. *The Joys of Mary* were dramatized, but only the texts of the First and the Seventh have come down to-day. The outstanding Miracle Play is that of *Mary of Nemmegen* (English translation by H. M. Ayres, *Dutch Library* III), a female Faust who sells her soul to the devil for the pleasures of the world; remorse seizes her and she is rescued from her satanic paramour by the Virgin. This little drama is one of the first examples of a play within a play. Of about the same date is the morality *Elckerlijc*, known in English as *Everyman*. The question as to which is the original version seems to have been settled in favor of the Dutch.

A decline is marked in the drama of the 16th century. The Morality (see MORALITIES) in which alle-

gories are the *dramatis personae* was the stock-in-trade of the playwright of this period. The language is stilted, the verse is tortured by artificial rhyme schemes and the plots are dull allegorical conceits. These plays in the vernacular strangely contrast with the excellence of the Latin school-plays written by the Dutch schoolmasters, Gnapheus (*Acolastus*, the story of the Prodigal Son), Macropedius (*Asotus*) and Crocus (*Joseph*). A revival of the drama in the Dutch language occurred at the beginning of the 17th century. A group of young writers in Amsterdam rebelled against sixteenth-century traditions. P. C. Hooft (1581-1647), an admirer of Italy where he had traveled in his youth, wrote a pastoral drama called *Granida* which shows the influence of Guarini's *Il Pastor Fido*, although the poet took his plot probably from an English original. Another novelty introduced by Hooft was the historical play in which the distant past was held up as a mirror to the present (*Geeraerd van Velsen*, 1613, *Baeto*, 1617). His best drama, however, is an adaptation to Dutch life and manners of Plautus's *Aulularia* (*Warenar*, 1615), in which he made the Greeks of the Latin comedy act and speak as burghers of Amsterdam. Terence's *Eunuchus* was naturalized in the same way by Gerbrand Adriaenszoon Bredero (1585-1618), whose farces and comedies, akin to the art of the genre painter, Jan Steen, are the high-water mark of Dutch comic literature. He has no equal in the realistic and humorous portrayal of everyday life in his native city of Amsterdam. His best known play is *Spanish Brabander*, in which he ridiculed the Brabant refugee's love of finery, his flaunting manners and his pretence at Spanish ceremoniousness, the plot being based on an incident in the picaresque novel, *Lazarillo de Tormes*. This was a play of great promise which, owing to Bredero's premature death, was not fulfilled. The leading dramatist of the 17th century was Joost van den Vondel (1587-1679). He remodeled the loosely constructed mystery play of the 16th century into a five-act drama in the classical style. Most of his plots are taken from the Bible; there is more speech than action; the dialogue is often disguised monologue, the second speaker's part being restricted to superfluous interruptions; dramatic thrills are lacking, since the classical style banned from the stage horrors and the clash of vehement passions. Vondel has given a clear account of his dramatic credo in the preface to *Jefta*, 1659. Dumb-show, dance and music were essential accessories to his drama. Its chief beauty, however, was the poet's magnificent verse. His work is a literary counterpart of that of Rubens; both were lovers of classical grandeur and had a taste for the baroque in decorative detail. Vondel's best known plays are *Palamedes*, 1625, a political allegory on the trial and execution of Oldenbarnevelt, *Gijsbrecht van Aemstel*, 1637, *Joseph in Dothan*, 1640, *Lucifer* (1654, English translation by L. C. van Noppen), *Jefta*, 1659, *Adam in Exile*, 1664, *Noah*, 1667.

After Vondel's death Dutch drama suffered a long

decline, from which it did not revive until the end of the 19th century. Slavish imitation of the French dramatists stifled all native originality. Only the comic genre was able for a time to resist the tyranny of the Paris vogue. The *Jan Klaassen* trilogy by Thomas Asselijn and a few comedies by Pieter Langendijk (1683-1756) are good specimens of the native tradition. In the 19th century Dutch drama was virtually non-existent. To FREDERIK VAN EEDEN and Marcellus Emants (1848-1921) Holland owes its resurgence. Van Eeden's versatility ranges from farce to tragedy, from satirical comedy to the stately historical play. Emants's greatest play is *Domheidsmacht* (*The Power of Folly*), in which the folly of a woman proves stronger than her husband's will to power and becomes the undoing of his career. These two pioneers were surpassed by Herman Heijermans, the writer of many successful problem plays presenting conflicts in the homes of the simple people, the North Sea fishermen, the Jews of the Amsterdam ghetto, the wage slaves of industry, the middle-class tradesmen. There are English translations of *Ghetto* and *The Good Hope*. Hatred of the power for evil in society is the fundamental tone of his drama, but its correlative is his love for the weak and the down-trodden. As his talent ripened, this softer feeling became predominant in his plays. In later years he conceived a deep admiration for GERHART HAUPTMANN, which may account for this turning from realistic to symbolic drama. *Uitsomst*, a play that deals with the dream visions of a dying child, shows affinity to *Hanneles Himmelfahrt*. But in the bulk of his work Heijermans was seldom dependent on literary inspiration. Not literature but life was his source-book.

Among modern playwrights the most prominent are J. Fabricius, who has written some striking plays of life among the Hollanders in Java, C. P. van Rossem, whose *Femina*, a skit on the modern woman, and *Pomarius*, in which he has his laugh at the official dispensers of justice, had long runs in Holland and abroad; and Mrs. Simons-Mees, who has given some good character studies in a number of plays for which some problem arising from the perplexities of modern life has supplied the plot.

A. J. B.

BIBLIOGRAPHY.—P. Leendertz, Jr., *Middelnederlandse Dramatische Poesie*; A. J. Worp, *Geschiedenis van het Drama en van het Tooneel in Nederland*.

DUTCH EAST INDIES, the Dutch possessions in the MALAY ARCHIPELAGO, comprising a territory of about 730,000 sq. mi. and a total population, in 1927 of close to 53,000,000. Among the chief islands are Java, Sumatra, Madura, Celebes, Amboina, Ternate, Bali, Lombok, Billiton, the Timor Archipelago and parts of Borneo and New Guinea. For purposes of administration they are divided into provinces, governments, residencies, divisions and regencies. The governor-general at BATAVIA, the capital, who is appointed by the Queen of Holland, holds executive authority and is assisted by a council of advisers also appointed by the Queen. The chief towns are Semarang, Surabaya, Padang, Medan and Macassar. The

bulk of the population are Mohammedans but there are about half a million Christians and as many belonging to Chinese and Japanese faiths. In 1928 the total production of sugar in the Dutch East Indies was approximately 3,000,000 tons. The output of coffee in the same year was 126,000 tons; of rubber, 232,000 tons, of tobacco 65,000 tons and of tea, 73,000 tons. These products together with spices and the medically important cinchona bark are the principal exports of the Dutch East Indies. Pop. 1927, 52,824,569.

DUTCH GUIANA, a colony of the Netherlands on the north coast of South America, bounded on the north by an Atlantic coast line of 240 mi., on the south by Brazil, on the east by French Guiana and on the west by British Guiana. Area 54,291 sq. mi. Cultivation is confined to reclaimed lands and other lowlands lying near the sea and a short distance up the five main rivers: the Surinam, Corentyn, Maroni, Coppename and Saramacca which all flow northward. A mountainous and forested region in the interior is virtually unexplored.

Sugar forms the principal export commodity of the colony; but the industry, aside from labor shortage, is handicapped in that the cane, in common with other crops, as a result of the unattractive climate tempered somewhat by trade winds, is especially susceptible to disease. Whereas in British Guiana the estates are near or along the sea, thereby receiving the cleansing effects of the breezes, in the Dutch colony, where the land is slightly higher at the coast, the plantations lie at some distance from the sea. In the latter lands the hot and humid atmosphere, relatively undisturbed by winds, proves very conducive to the spread of disease. Among less important crops, coffee ranks second to sugar. In addition, quantities of cacao, rice, cotton, coconuts, corn and fruits contribute to agricultural production. Balata has long been the leading product of the forest, where timber resources are tremendous, but in common with the conditions in most of tropical South America poor means of transportation present handicaps.

Gold has been an important product in Dutch Guiana since 1876. The leading workings are almost entirely placers. Difficulties of transportation and exhaustion of richer deposits have caused a steady decrease in output in late years. Recent developments in bauxite have tended to compensate for the decreases in gold. Directly accessible to ocean-going steamers, the bauxite mines lie about 100 mi. from PARAMARIBO, the capital.

In the settlement of one of the many wars of the 17th century, Holland gave up New Amsterdam, now New York, to the British in exchange for the colony of Dutch Guiana. At that date, 1667, tropical colonies were more highly valued than those in colder climates, and South America was considered more promising than North America. Pop. 1929, 148,960, mainly Negroes and Asiatic half-castes and less than 200 whites. A few tribes of uncivilized Indians occupy the interior.

History. The first Dutch settlement in Guiana was established in 1590 on the Demerara River in what is now British Guiana. From this colony other colonies spread to the Essequibo and Berbice rivers. The Dutch were from the first rather successful, for the geography of the land was much like that of Holland, necessitating the dykes and sluices which the Dutch were experienced in building. Dutch Guiana of the present day was originally the territory about the English settlement of Surinam, and was ceded in 1667 to Holland in exchange for New Amsterdam or New York. Under Gov. Sommelsdijck, 1683-88, Dutch Guiana was prosperous and enjoyed good government. However, during 1715-77 a disastrous servile war severely retarded the colony. Slavery was not abolished until 1863. During the 19th century the colony decayed along with the other European colonies about the Caribbean, owing partly to the disinterestedness of the Dutch. Some revival of interest in Guiana has been evidenced in the 20th century by the establishment of agriculture experiment stations and the conduct of various scientific researches.

DUTCH LANGUAGE, a Low German language of the GERMANIC group of the INDO-EUROPEAN linguistic family.

It is the literary language of Holland, and Germanic portions of Belgium (Flanders), as well as of the South African Boers, and is likewise a comprehensive term for the Low Franconian, Low Saxon and mixed Frisian dialects spoken in these regions. In the Northern Netherlands it is also called Hollandish, in the Southern, Flemish, and throughout, Dietsch, whence the English term. It originated in the second half of the 12th century from Low Franconian dialects, and attained a high degree of polish in the 13th, first with Flemish and then with the dialect of Brabant, the southern dialects becoming paramount in the 16th century. The basis of the present literary language is formed by the orthography adopted in the Northern Netherlands in 1804, the endeavors toward a unification for North and South leading to the adoption of the orthographic system of de Vries and te Winkel in Belgium in 1864, and in the Northern Netherlands in 1881.

BIBLIOGRAPHY.—J. van Ginneken, *Handboek der nederlandsche Taal*, 2 vols., 1913-14; J. te Winkel, "Geschichte der niederländischen Sprache" in H. Paul, *Grundriss der germanischen Philologie*, 2nd ed., 1896; D. C. Hesseling, *Het Afrikaansch*, Leiden, 1899.

DUTCH LITERATURE can be said to date only from the 16th century, notwithstanding the fact that chronicles from the 13th and 14th centuries are extant, and that troubadours achieved during the same period a certain popularity with their poems, some of which were translations from the French. But with the Renaissance in the 16th century, Dutch writers began to produce literature in the strict sense of the term. Such men as the far-famed ERASMUS, Daniel Heinsius and Grotius, the last two writing in their native idiom instead of in Latin, achieved a reputation far beyond the boundaries of their own

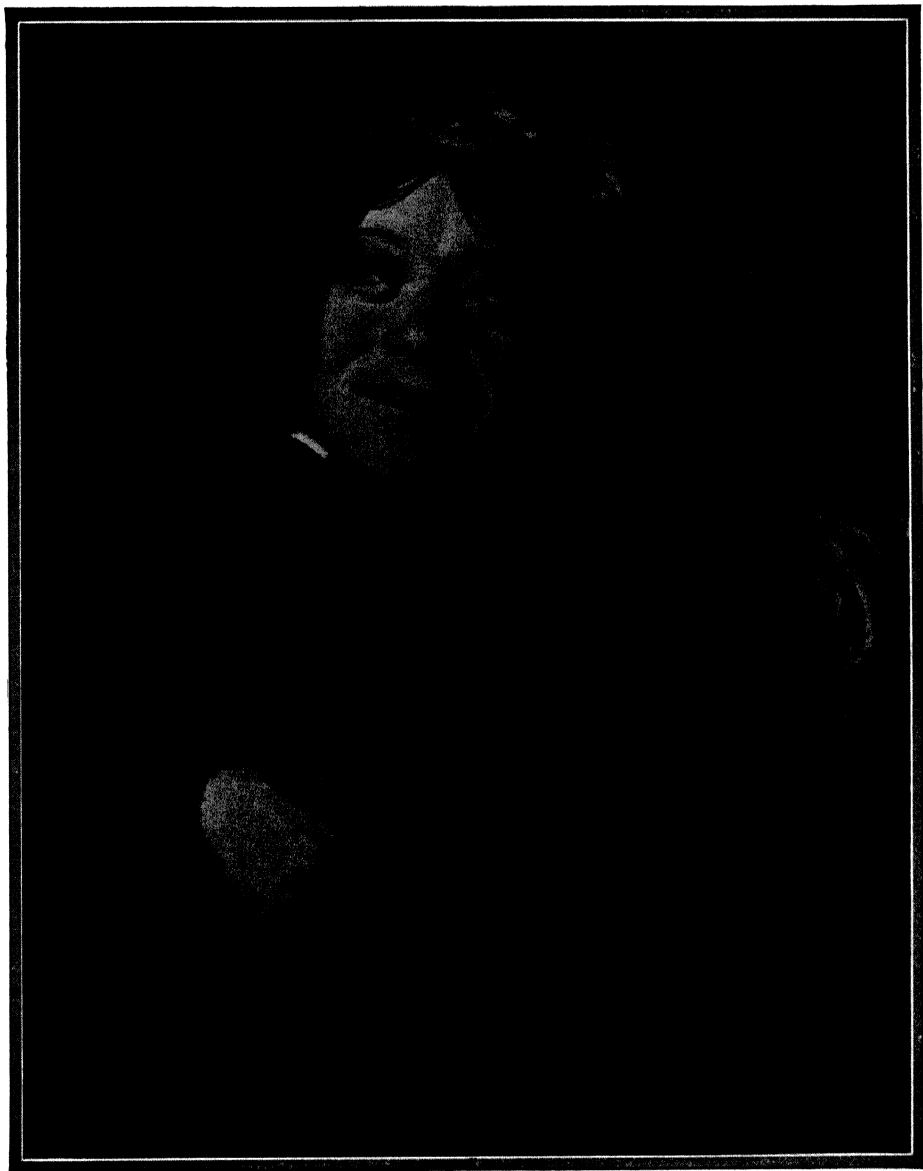
country. During this period the violent political outbreaks that finally tore the Netherlands from the hated domination of Spain had their influence on Dutch literature. Marnix de Sainte-Aldegonde (1538-98), one of the leading Dutch patriots, was the author of widely popular poems and violent political pamphlets. His prose satire, *Bijeaorkof*, remains one of the outstanding achievements of the literature of his country. Writing at about the same time were L. Spiegel (1549-1612), Roemer Wischer (1547-1625), L. Reaal (1583-1637), and the fabulist, Jakob Cats (1577-1660), all writing in the Dutch language and thus increasing its importance as a literary medium. The poems of these writers were characterized by considerable tenderness and touching simplicity, celebrating as they did the joys of family life, the beauties of nature, and the love of home and one's native land.

In the 17th century P. CORNELIUS HOOFT (1581-1647) and JOOST VAN DEN VONDEL (1587-1679) were the outstanding Dutch writers. Both wrote with equal facility in prose and poetry, although Hooft's best works were mainly historical, and Vondel reached his pinnacle in drama. Hooft's masterpiece is his *History of Belgium*; Vondel, the greatest of all Dutch imaginative writers, achieved overwhelming success with dramas based on Biblical subjects and with an historical play, *Gysbrecht van Amstel*. All these do high credit to the Dutch drama. Other dramatists of this time were Jan Vos, Joachim Oudaan, Andrius Pels, C. Lescaille and Huijdecoper. Historical writing was represented by G. Brandt, P. Valkenier, J. Lecler and G. van Loon. The poets of the same period were Heymann Du Claert (1636-84), Gisbert Japix (1603-66), Anslö (1622-69), who wrote a striking poem, *The Plague of Naples*, C. Poot (1689-1733), who sprang from the peasantry and possessed a vein of genuine originality, and Van Fockenbrock (1640-79), whose comic talents brought him immense popularity. Another outstanding figure of the period was Just van Effen (1684-1735), the father of Dutch journalism, who founded the periodicals *The Spectator* and *The Misanthrop*.

During the 18th century Dutch literature turned to France for its models. Feitama (1694-1758) translated many successful French works into Dutch. A woman, Wilhelmina de Merken (1722-89), introduced contemporary English models, and her plays, *David*, *Germanicus* and *Marie de Bourgogne*, gave proof of originality and of a profound knowledge of Shakespeare's plays.

The most remarkable writer of the 19th century in the Netherlands was Bilderdijck (1756-1831), whose versatility was astonishing. He excelled in all forms of composition, lyric poetry, drama and prose, and he founded a new school of poetry of which the outstanding disciple was H. Tollens (1780-1856), whose poems are possibly superior to any that have since been produced in Holland. Among prose writers may be named Beets, who has been called the Charles Dickens of the Dutch, and Schimmel, both of whose

DUTCH SCHOOL OF PAINTING



"THE JESTER"

By Frans Hals (1584?-1666). A portrait of Adriaen Brouwer, one of Hals' favorite pupils, now in the collection of Baron Robert de Rothschild, Paris.

works have been translated into English. Van Lennep wrote exciting novels which were also read in English-speaking countries.

Dutch literature entered into a fresh period towards the latter part of the 19th century. Two poets, Jacques Perk and Marcellus Emants were among the pioneers in the new movement, and the outstanding novelists were Hendrik Conscience, "Miss Wallis," (Adèle Opzoomer), Mrs. Bosboom Toussaint and Douwes Dekker, who wrote under the name of "Multatuli." Dekker's *Max Havelaar* was translated into most European languages.

The outstanding Dutch novelist of the 20th century is LOUIS COUPERUS (1863-1923). He won international fame and his novel, *Old People and the Things that Pass*, had a wide circulation in English-speaking countries. The leading dramatist, who was almost exactly contemporary with Couperus, was Herman Heyermans (1864-1924). His powerful dramas, of which *Ghetto* is perhaps the most representative, are gloomy presentations of various sociological problems.

BIBLIOGRAPHY.—G. Kalf, *Geschiedenis der Nederlandsche Letterkunde*, 1906-12; J. Winkel, *De Ontwikkelings der Nederlandsche Letterkunde*, 1908-21; J. Prinsen, *Geïllustreerde Nederlandsche Letterkunde*, 1924.

DUTCHMAN'S BREECHES (*Dicentra Cucularia*), a charming early wild flower of the fumitory



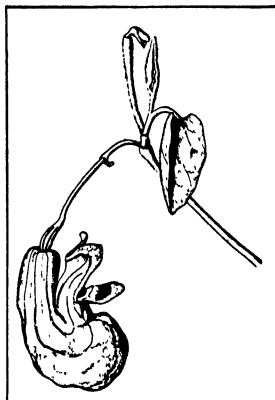
DUTCHMAN'S BREECHES

Parts of flower and single flower (left), flower cluster and leaves (center), and bulb (lower right)

family found widely in moist woods in eastern North America. It is a smooth, delicate perennial with finely dissected basal leaves and slender flower-stalks, 5 to 10 in. high, rising from a granular bulb. The handsome creamy-white flowers, sometimes tinted with pink, bear two thickish flattened spurs in shape somewhat resembling a pair of baggy trousers.

DUTCHMANS PIPE (*Aristolochia durior*), called also pipe-vine, a twining vine of the birthwort family native to rich woods from Pennsylvania to Minnesota, southward to Georgia and Kansas, and widely cultivated for ornament. The stem, sometimes an inch in diameter and 30 ft. long, bears very slender green

branches, large kidney-shaped or roundish leaves, 6 to 15 in. broad, and peculiar pipe-shaped, yellowish-green flowers with a flat, purple-brown three-lobed limb. See also *ARISTOLOCHIA*.



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

WESTERN DUTCHMANS PIPE
Aristolochia californica

DUTCH SCHOOL OF PAINTING, a school that developed and became famous with the political independence of Holland in the 17th century. It was unique as a national school in that it confined itself to the portrayal of its own land and people. The artists themselves exhibited the Dutch characteristics of independence and self-sufficiency together with a love of literal fact in trivial detail, so that they took little from each other or from the outside world either in technique or point of view. There is, however, a distinguishing Dutch stamp on all their work. To national traits were added the contributing factors of religious and social conditions that placed Dutch art in a class apart. Rigid Calvinists, the Dutch frowned not only on religious subject matter, but also on that derived from pagan mythology and allegory. Historic paintings of sovereigns and palaces were equally distasteful to their republican independence. A self-centered, externalized people, their art reflects their interest, which was themselves. Their portraits and landscapes portray their delight in gayety and its sensuous contributing factors in color and the objects of everyday life; the delicate tracery of a lace cuff with the sheen of the velvet sleeve beneath gave them more pleasure than any vision of ideal beauty. The Dutch painters were the greatest colorists of the North, combining with their preeminence in this line, which each worked out for himself, an extraordinary handling of light and shade, also independently mastered in each case. The visual illusion of space through the use of the open window was almost constantly striven after in the painting of interior scenes. Their interest in detail led Dutch painters to perfect themselves in some one subject, such as por-

traiture, including the favorite corporation pictures, i.e., a large composition of individual portraits of members of a guild, usually gathered round a table in a drinking bout; or genre landscape and marine or still life. Practically all of the Dutch School were excellent portrait painters, but among those most representative were FRANZ HALS (1584-1666), one of the most remarkable portrait painters in history; Mierevelt (1567-1641); and Nicholas Maes (1632-93). Among the genre painters were Jan Vermeer (1632-75), Pieter de Hooch (1630-77), Adrian van Ostade (1610-85), Jan Steen (1626-79), Gerard Terborch (1617-81) and Gabriel Metsu (1630-67). Landscape and marine painters included Jan van Goyen (1596-1656), Jacob Ruysdale (1625-82), Hobbema (1638-1709), Wilhelm van der Velde (1633-1707) and Bachhuysen (1631-1708). Still life, interiors and architecture were represented by David de Heem (1600-74), Van der Heyden (1637-1712), Pieter Neefs (1578-1656) and Willem Kalf (1630-93). Josef Israels (1824-1911) was the most important influence in the modern revival of Dutch art and one of the greatest all-round painters of Holland. REMBRANDT VAN RIJN (1606-69) stands apart so preeminently as a great genius that he is seldom classed with the Dutch School. So greatly unlike the rest of his countrymen, he received nothing and was unable to transmit to his followers the secrets of his technique.

DUTTON, IRA B. (1843-1931), a Trappist lay brother, who, as "Brother Joseph," served the lepers in Kalawao, Molokai, Hawaii, for 45 years. He was born at Stowe, Vt., Apr. 27, 1843, and was educated at the Academy, Milton, Wis. In the Civil War he joined the 13th Wisconsin Volunteer Infantry, attaining a captaincy. After the war he engaged in business and joined the Protestant Episcopal Church, but later became a Catholic and entered the Trappist Monastery at Gethsemane, Ky. In 1886, stirred by the example of FATHER DAMIEN, he went to Molokai. He declined to receive any remuneration and became renowned for his work with the lepers. He escaped leprosy but died of hard work and old age at Honolulu, Hawaii, Mar. 26, 1931.

DUTY, in ethics, the principle of moral compulsion. It is often set in contradistinction to desire as something more compelling and restraining. In the ethics of IMMANUEL KANT there is an inevitable conflict between duty and desire, duty standing for what reason dictates, desire being represented by the particularity of sense. Dewey's (See DEWEY, JOHN.) conception is that duty itself is not felt when present habits are adequate to the situation in which the self is operating; it is felt when the habitual self is not adequate to the situation, and hence experiences a conflict between the better that is conceived and the impulses and habits already active.

DUTY OF WATER, sometimes called "the irrigation requirement of arable land," deals with water allotments for agricultural purposes and is an important function of the legal, administrative, engineering, economic, financial and agricultural phases of

irrigation. The term "duty of water" is said to have originated in British India where it signifies the work which water is supposed to do, expressed in terms of a unit of flowing water over a given acreage.

In conveying irrigation water from its source to the farm, there are conveyance losses, so that the duty fixed at the intake of the canal will vary from the duty at the margin of each farm. Hence, there are the terms "intake duty" or "gross duty" meaning the average duty under an entire supply system, including all water lost in transit, and "net duty" or "delivered duty," meaning the amount of water applied to individual farms when measured at the margin of each.

The terms "irrigation requirement" and "water requirement," which have recently come into use, are not synonymous, since the first refers only to water artificially applied, while the second refers to the total quantity of water, regardless of its source, required by crops.

Still another term expressing duty of water is "consumptive use of water" which refers to the quantity used in each natural subdivision of intrastate rivers. This expression takes into account the re-use of return water of a river which might flow through several valleys, the essential factor to be determined being the consumptive use in each valley.

Duty of water is fixed by statute in several western states, Idaho fixing one second-foot to each 50 acres; Wyoming, Nebraska, Oklahoma, New Mexico and South Dakota, one second-foot to 70 acres; and North Dakota one second-foot to 80 acres. A. T. M.

DUUMVIRATE (*Ilviri*), a board of two men of ancient Rome; e.g., the *Ilviri perduellionis*, appointed by the *comitia curiata* (see COMITIA) to try cases of treason and, in case of appeal, to bring them before the *comitia*. The most important, the *Ilviri potestate aedilicia* and *Ilviri iudicando*, the highest magistrates in the municipia, presided over the local senate and had charge of the laws, public works and funds.

DUVENECK, FRANK (1848-1919), American artist, was born at Covington, Ky., Oct. 9, 1848. He studied under Diez in the Royal Academy at Munich. His first exhibition in Boston in 1875 was widely acclaimed. In 1878 the painter opened a school at Munich which attracted a host of promising young artists. He made a number of excellent etchings and sculptures, among the latter, a notable monument to his wife. His paintings include *A Circassian*, *The Professor* and *Turkish Page*, in the Pennsylvania Academy, and nine paintings in the Cincinnati Museum. After 1888 Duveneck was associated with the Cincinnati Museum and Cincinnati Art Academy. He died in Cincinnati, Jan. 3, 1919.

DVINSK. See DAUGAVPILS.

DVOŘÁK, ANTONIN (1841-1904), Bohemian music composer, was born at Mulhausen, near Kralup, Sept. 8, 1841. He was the chief composer of his country in the 19th century. His success dates from 1873 when a patriotic cantata, *Die Erben des weissen Berges*, was performed; the following year two of his

symphonies won a hearing, and international recognition shortly followed. In 1892 he visited the United States, serving as director of the National Conservatory of Music until 1895, meanwhile collecting American negro melodies as a basis for his most popular symphony, *From The New World*. He returned to Bohemia, becoming director of the Prague Conservatory in 1901. His compositions include six operas, an oratorio *St. Ludmila*, an admirable *Siabab Mater*, and five symphonies, in addition to a small amount of chamber music. He died at Prague, May 1, 1904.

DWANUSH, a small Salish-speaking American Indian group whose aboriginal territory lay at the mouth of Lake Washington in Washington. The few remaining members of the tribe were combined with the SNOHOMISH.

DWARF STARS, a rather loosely applied term, meaning those STARS that are either fainter than the sun, or not more than about 50 times brighter.

DWIGHT, THEODORE WILLIAM (1822-92), American jurist, was born at Catskill, N.Y., July 18, 1822. After studies at Hamilton College and at Yale Law School he was admitted to the bar in 1845. The next year he was chosen Maynard professor of law at Hamilton College where he founded and was warden of the law school. In 1858 he became professor of municipal law at Columbia University where he also established a law school and with which he was associated until 1891. He died at Clinton, N.Y., June 29, 1892.

DWIGHT, TIMOTHY (1752-1817), American educator and theologian, was born at Northampton, Mass., May 14, 1752. On graduation from Yale University in 1769, he taught at New Haven, Conn., returning to Yale as a tutor 1771-77. He was an army chaplain for a year during the Revolutionary War. From 1783-95 he was pastor of a Congregational church in Greenfield, Conn. In 1795 he became president of Yale, serving with great distinction until his death. The most important of his many writings was his *Travels in New England and New York*, 1821-22. He died at New Haven, Conn., Jan. 11, 1817.

See W. B. Sprague, "Life of Timothy Dwight," in J. Sparks, *Library of American Biography*.

DWIGHT, TIMOTHY (1828-1916), American educator and clergyman, was born at Norwich, Conn., Nov. 16, 1828. On graduating from Yale University in 1849, he studied theology there for three years. From 1855-58 he studied at Bonn and Berlin. Then he returned to Yale Theological Seminary as a professor and in 1886 became president of Yale, the second Timothy Dwight to serve in that office. From 1866-74 he was the editor of the *New Englander* and from 1872-85 was a member of the American Committee for the revision of the English version of the Bible. He died at New Haven, Conn., May 26, 1916.

DYEING, the process of applying coloring matter to textiles and similar materials. Dyeing implies more or less permanent coloring as opposed to tinting; and, usually, a uniform coloring of the entire fiber, yarn, or fabric as opposed to printing. Dyestuffs (see DYES,

SYNTHETIC; DYES, NATURAL) may be applied to cotton, wool, silk, rayon, and all other vegetable, animal, and synthetic fibers. Like BLEACHING, dyeing can be accomplished at practically any stage in the manufacture of textiles, from raw stock to finished fabric.

Dyestuffs are grouped as natural, mineral, and synthetic colors. The last group is by far the most important, there being several thousand synthetic dyestuffs, mainly derivatives of COAL TAR. Dyestuffs are further divided into classes according to their chemical constitution and method of application. Among the most important classes of synthetic dyestuffs are included direct, acid, developed, basic, sulphur, vat, mordant, azoic, and dispersol dyes.

Textiles which have been prepared for dyeing by scouring, degumming, or bleaching, are dyed by immersing and working them in the dyebath for the required length of time. After dyeing is completed, the materials are usually rinsed and, in many instances, are treated with solutions of inorganic salts or other agents which increase the fastness of the dyes. Several classes of dyestuffs have an affinity for one or more fibers and may be applied directly to them. Others have no direct affinity for fibers; these are applied by treating the material with a metallic salt, tannic acid, or other MORDANT which is absorbed by the fiber and which at the same time combines with the dyestuff to make it fast.

Important factors in the actual dyeing process are the concentration of the dyebath, the temperature of the solution, and the duration of the treatment. A variety of chemicals are used in dyeing to aid in the production of level shades, to increase penetration, or to enable more complete absorption of the color. Sodium sulphate, sodium chloride, sodium carbonate, sulphuric acid, acetic acid, soap, sulphonated oils, and a number of proprietary compounds—known as penetrants or dye assistants—are among the more commonly used products.

There are numerous types of equipment available for dyeing, the choice depending on the particular textile to be processed, stage of manufacture at which it is to be dyed, class of dyestuff used, and whether continuous or batch dyeing methods are employed.

W. W. C.

BIBLIOGRAPHY—J. M. Mathews, *Application of Dyestuffs*; C. M. Whitaker, *Dyeing with Coal Tar Dyestuffs*.

DYER, JOHN (1700-58), British poet, was born at Aberglasney, Carmarthenshire, Wales, in 1700. He was at first an artist, and wandered through England and south Wales. His *Gonger Hill* appeared in 1727 and *The Ruins of Rome* in 1740. The following year Dyer was ordained a priest, and held several charges. *The Fleece*, his best known poem, is mentioned by Wordsworth in the sonnet he wrote to Dyer. His verse has freshness and charming descriptions of scenery. He died at Coningsby, Dec. 15, 1758.

DYERSBURG, a city in northwestern Tennessee, the county seat of Dyer Co., situated 70 mi. northeast of Memphis. It is served by two railroads. Cotton,

corn and small fruits are grown extensively. The city has cotton mills, compresses, gins, cottonseed oil refineries and other industrial plants. Dyersburg was founded in 1826. Pop. 1920, 6,444; 1930, 8,733.

DYES, NATURAL, coloring matter occurring in nature or derived from natural products, of animal, vegetable or mineral origin. Among the first, may be mentioned Tyrian purple, derived by crushing and oxidizing sea snails occurring in the eastern Mediterranean, known in the time of Moses; and the carmine COCHINEAL, obtained from the female of a species of plant louse indigenous to Mexico and Central America. The vegetable dyes comprise the largest class of natural dyes and include: **INDIGO**, an intense blue derived from the stems and leaves of an Asiatic plant, known to the Egyptians more than 4,000 years ago; **ALIZARIN**, obtained from the root of the madder; and a host of other dyes, generally yellow to brown in color, prepared from the roots, bark or wood of trees and plants, such as Brazil-wood, camwood, fustic, quercitron, turmeric, black logwood, and many others.

Natural dyes have been largely replaced by synthetic dyes, often of identical chemical composition because the latter can be made more cheaply or on a larger scale or because they constitute new compounds which offer a greater variety of shades and hues. Mineral coloring matters, such as chrome yellow and Prussian blue, are now little used as dyes but find application mostly as pigments in paints (*see PAINT AND ITS MANUFACTURE*) and varnishes (*see VARNISH*) or in ceramic materials.

W. J. L.

DYES, SYNTHETIC, coloring matter made very largely from COAL TAR and its derivatives, such as ANILINE; also called coal-tar dyes. They may be segregated into numerous classes in different ways, either by the mode employed in dyeing with them or by their chemical composition. Among the more important classes are: the *azo-dyes* (*see AZO-COMPOUNDS*), several hundred of which are in use, ranging in shade from yellow and red to deep blue, violet, and black. Some such, as paranitraniline red, or "para-red" are insoluble in water and hence, once deposited upon the fiber, are very "fast" to washing. The *carbonium* or TRIPHENYLMETHANE dyes, which include FUCHSINE, and the magenta series possess vivid colors, but are not so fast against light and washing. The *azine*, *oxazine*, and *thiazine* classes, often grouped together as the quinone-imides, include the dark blue INDULINES, the SAFRANINES and nigrosines and generally have an exceedingly complicated structure, aniline black, for example, having no less than 11 benzene nuclei in its molecule. The *indigoid dyes*, of which INDIGO itself is the principal representative, and ANTHRACENE or ANTHRAQUINONE dyes, which include ALIZARIN, are collectively known as "vat-dyes," and range among the fastest dyes known. The smaller groups include the HYDRAZONES with the brilliant yellowish green, very fast dye, tartrazine; the heterocyclic *thiazoles* and *xanthenes*, the former comprising primulin, the latter the rhodamines, Eosines, and FLUORESCIN; and, finally, the sulphur group of

dyes, to which belongs the coloring matter of khaki. Depending upon the reaction of the solution used in their application, these dyes are classed as acid or basic dyes. Direct cotton dyes are those which, like the azo-dyes, can be fastened onto the cotton fiber directly, while MORDANT dyes, such as alizarin, require the use of a metallic mordant. *See also DYEING*.

W. J. L.

DYETSKOYE SELO, formerly called Tsarskoye Selo, a Russian town about 15 mi. south of Leningrad. It was originally a Finnish village captured by Peter the Great and, due to its healthful climate, turned into a summer resort for the imperial family by the Tsaritsa Elizabeth and Catherine II. Then it was called Tsarskoye Selo (The Tsar's Village); the present name means Children's Village. The town became noted throughout Russia for its modern improvements in water supply, sanitation and electricity. In 1837, the first Russian railway was built between St. Petersburg and Tsarskoye Selo. The Soviet government has converted the town into a health resort for children. To this end, the palaces and villas have been turned into museums, hospitals, schools and sanatoriums for children.

DYNAMICS. *See MECHANICS.*

DYNAMITE, a mixture of a high explosive, usually nitroglycerine and nitroglycol, and an absorbent comprising a mixture of ground sodium nitrate, wood pulp, corn meal, ground ivory nut or other carbonaceous materials. Ammonium nitrate may be substituted for a part of the nitroglycerine and sodium nitrate, because in such a mixture it contributes to the explosion. Gelatin dynamites contain, in addition, a small amount of soluble nitrocellulose dissolved in the nitroglycerine to form a jelly, thus imparting to the dynamite a dough-like consistency and an imperviousness to water. Nitro-starch is used to some extent in place of nitroglycerine, its use preventing the severe headaches suffered by some persons when handling nitroglycerine dynamites.

Many varieties of dynamite are made for various purposes, and in numerous sizes of cartridges. Dynamite may vary from the stiff blasting gelatine comprising 92% nitroglycerine and 8% soluble nitrocellulose; to 10% nitroglycerine, 80% ammonium nitrate, and 10% carbonaceous matter; or even 5% nitroglycerine and 95% of a mixture of ground coal and sodium nitrate. The uses of dynamite vary from breaking the rock at the bottom of a harbor, to the slight shock required to knock down an undercut face of coal. *See also EXPLOSIVES.*

E. M. Sy.

DYNAMO-ELECTRIC MACHINE, a machine for converting mechanical energy into electrical energy, or vice versa. It usually comprises an ARMATURE and a field (*see FIELD, DYNAMO-ELECTRIC*) one of which, the rotor, rotates, while the other, the stator, is stationary. When the machine converts mechanical into electrical energy it is termed a generator, and its rotor is driven by a PRIME MOVER, such as a steam turbine. (*See TURBINE, STEAM.*) When it converts electrical into mechanical energy it is called a motor,

and its rotor may be made to drive some machine, such as a machine tool or a water pump.

The operation of the generator is dependent upon the principle that when a conductor forming part of a closed circuit is moved through a magnetic field so as to cut the magnetic lines of force a current is set up in that circuit. See **MAGNETIC INDUCTION**. The magnetic field is established by one or more **ELECTROMAGNETS**, or pairs of poles, which make up the "field" part of the machine. The conductors cutting these magnetic lines of force are the armature winding.

Motor operation is just the reverse of that of the generator. If a current is passed through a conductor surrounded by a magnetic field, the conductor will be acted upon by a magnetic force tending to move the conductor with respect to the field. In a motor this force exists as attraction or repulsion between the magnetic field set up by the field magnets and that set up by the flow of current through the conductors of the armature.

In both the generator and motor, the field poles and armature conductors are so arranged with respect to one another that all the reactive forces are in the same circumferential direction. See also **ELECTRIC GENERATOR**; **MOTOR**, **ELECTRIC**. H. M. H.

DYNAMOMETERS, instruments for measuring the Power, developed by any means, and exerted to produce either linear or rotary motion. Two broad types may be distinguished: 1. The *Absorption* type, in which the work to be measured is converted into heat; and 2. The *Transmission* type, in which the work is measured before transmission. Typical of the first are the "Prony" Brake and the Allen dynamometer in which the revolving shaft is braked down by various means to the speed at which the power developed is to be determined. The frictional resistance set up by this braking is measured in terms that can be translated into *Torque* which, taken with the speed of rotation, indicates the power developed at the instant the torque was determined. In the transmission type, a spring, rather than friction, is employed to indicate the torque, or the linear force developed by, say, a locomotive or a team of horses; or on the other hand, the resistance set up by a vehicle moving on various types of roads. M. Sc.

DYNATRON, a three-element electronic tube (see **TUBES, ELECTRONIC**) containing a **CATHODE**, a **GRID** and a **PLATE**. The grid is maintained at a positive potential higher than the plate, so that secondary electrons are emitted from the cold plate when the latter is bombarded by the electrons from the **FILAMENT**.

DYNE. See **UNITS, PHYSICAL**.

DYSENTERY, a disease of the intestines having as its chief characteristic diarrhea with bloody stools. There are two distinct forms, bacillary dysentery caused by the *Bacillus dysenteriae*, and amebic dysentery or amebiasis caused by a species of ameba called the *Entamoeba histolytica*. Still other forms are brought on by other intestinal parasites.

Bacillary Dysentery. Bacillary dysentery is not a very rare disease, occurring in warm and temperate

countries alike. It causes great devastation in camps of armies at wartime and breaks out in crowded institutions such as asylums. The source of the infection is usually contaminated water supply, but it can be transmitted also by contaminated food. In this form, high temperature may be present, exhausting bloody diarrhea, and vomiting. The mucous membrane of the intestine is attacked and becomes greatly thickened and highly inflamed. Necrotic or gangrenous areas may result, which are followed by ulceration. In the acute form mortality is very high. The subacute form may continue many months. The acute form may also pass into the chronic form, or relapses may occur, characterized by diarrhea and great emaciation. Bacillary dysentery may have complications, such as peritonitis, intestinal hemorrhage and arthritis.

The treatment of acute bacillary dysentery is rest in bed with hot abdominal applications; water drinking is restricted and a diet of egg albumen, barley and rice water, and strained gruels given. In case of vomiting, food by mouth is entirely cut off for several hours. Early in the disease purgation is advisable and bismuth subnitrate in large doses is beneficial, together with measures established for the relief of pain. A serum treatment has some value if given early in the course of the disease. In the chronic form, rectal irrigations, medicated as the case calls for, are the procedures of most value.

Amebic Dysentery. Amebic dysentery is very prevalent in tropical countries, and is also common in the southern part of the United States, sometimes becoming epidemic. It is transmitted through contaminated water and uncooked fruits and vegetables. Besides the latent form which can exist without knowledge, there is an acute form and a milder chronic type. In the *acute form* the intestines are affected in much the same way as in bacillary dysentery and the parasites may be carried to the liver and lungs, producing abscesses. In the acute form of this type of dysentery there is ulceration of the intestines, with bloody diarrhea and the passing of mucus, accompanied by extreme pain and straining. The patient loses weight and becomes thin and weak, and death may quickly follow. Intestinal hemorrhages may also occur and peritonitis upon the rupture of an ulcer. In the *chronic cases* the symptoms are milder but continuous, with attacks of diarrhea and constipation alternating over a long period of time.

In the treatment of amebic dysentery rest in bed and a liquid diet are essential. The abscesses are drained when present. Emetine is a specific remedy for this disease, although a long period of treatment is often required to produce a cure. (See also **TROPICAL MEDICINE**.) W. I. F.

DYSPEPSIA, or **INDIGESTION**, a symptom-complex apparently originating in the stomach, but in reality more often due to derangements elsewhere, most especially in the abdominal and pelvic cavity, which is also known as the peritoneal cavity. Thus,

the well-known vomiting of pregnancy is produced by irritation arriving from the expanding womb. In the vomiting of gallstone or of renal colic, of incarcerated hernia or of appendicitis, we have other examples of complete upsetting of a stomach that is not itself sick. Thus the stomach may "speak" for disease arising anywhere else in the peritoneal cavity.

Hence, it will not be surprising that gastric symptoms such as belching, eructations and heartburn, loss of appetite, nausea, abdominal discomfort, heaviness, bloated feeling after meals, even pain in the region of the stomach, may be, indeed, commonly are due to disease outside of it. Thus many a person, who harbors gall-stones has passed for years as a dyspeptic until the successful removal of the gall-stones cured the "dyspepsia." Stasis in the large bowel may reflect itself in gastric disturbance, often with additional symptoms of so-called, "biliousness," foul taste in the mouth, halitosis, yellow coating of the tongue, headache, dizziness and cantankerous disposition.

Irritation outside of the stomach may produce spasm of its opening, spoken of as pylorospasm; and this, in turn, is frequently the cause of gastric hyperacidity. It is quite probable that, upon this basis develop the chronic ulcers of the stomach or duodenum, so-called peptic ulcer, primarily due to a localization

of infection but kept from healing by the existing unfavorable conditions.

Of course, dyspepsia also does arise from disease of the stomach itself. We have, for example, the gastric catarrh of the drunkard, with its well-known morning vomit and its inability to do its work unless goaded on by the ardent spirit that causes and still further aggravates the disease. Excepting as caused by alcohol, gastritis, or true inflammation of the stomach, is a rather rare disease in the adult.

CANCER of the stomach, with its train of symptoms of dyspepsia, is to be especially suspected when an elderly person, who has had excellent digestion, commences to suffer from gastric disturbance without definite cause.

One fact that must become evident from this brief discussion is that, what the ignorant may be pleased to call a simple "dyspepsia," may require a complete study of the gastro-intestinal tract, with test meal, X-ray and stool examination, to diagnose properly and treat it.

B. F.

DYSPROSIUM, a metallic chemical element belonging to the rare earth group, occurring in the mineral gadolinite. Its chemical symbol is Dy; at. wt. 162.46. Its salts form greenish-yellow solutions. It was discovered by Lecoq de Boisbaudran in 1886.

W
3344